18 JANUARY 1951 ONE SHILLING

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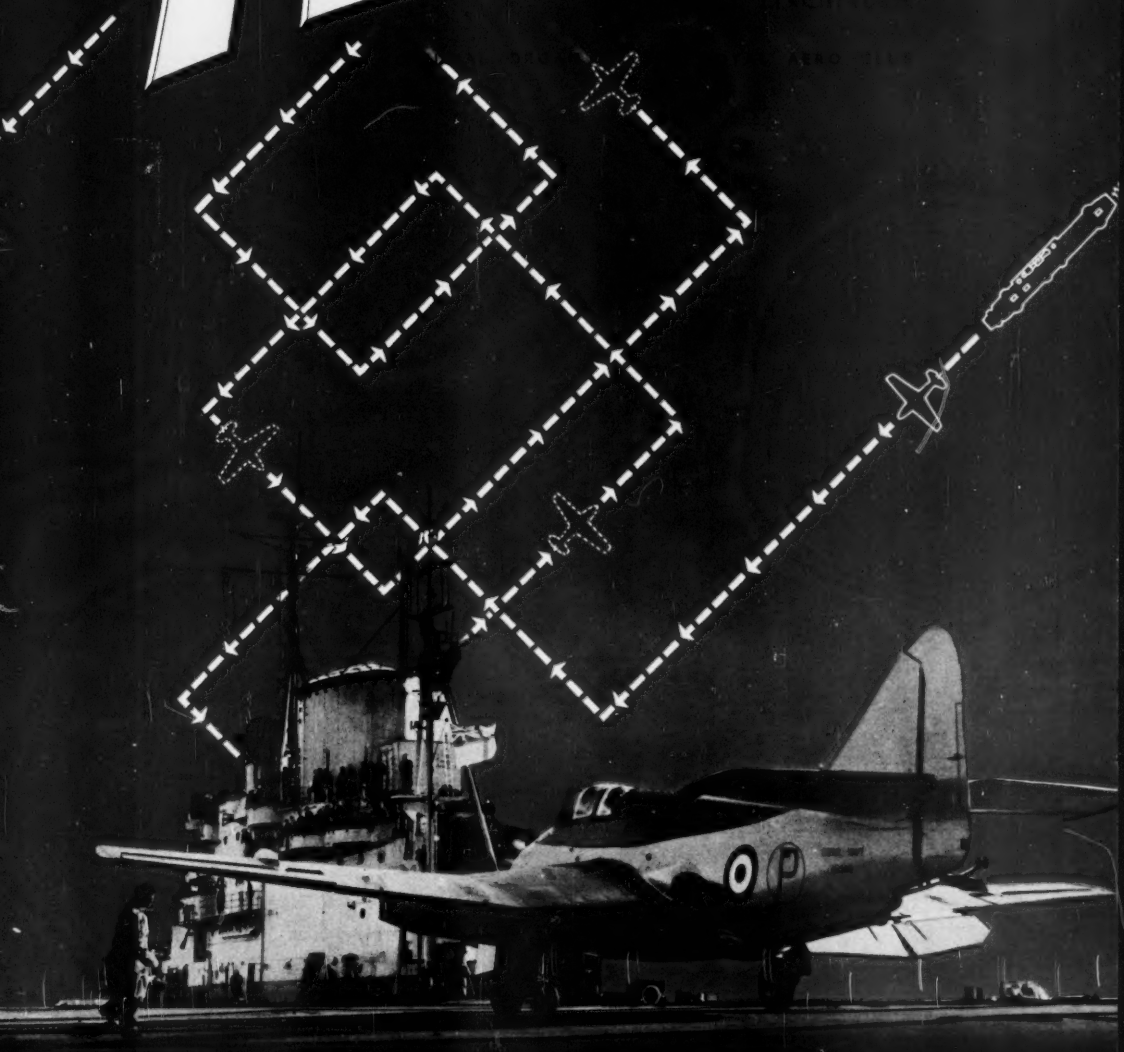

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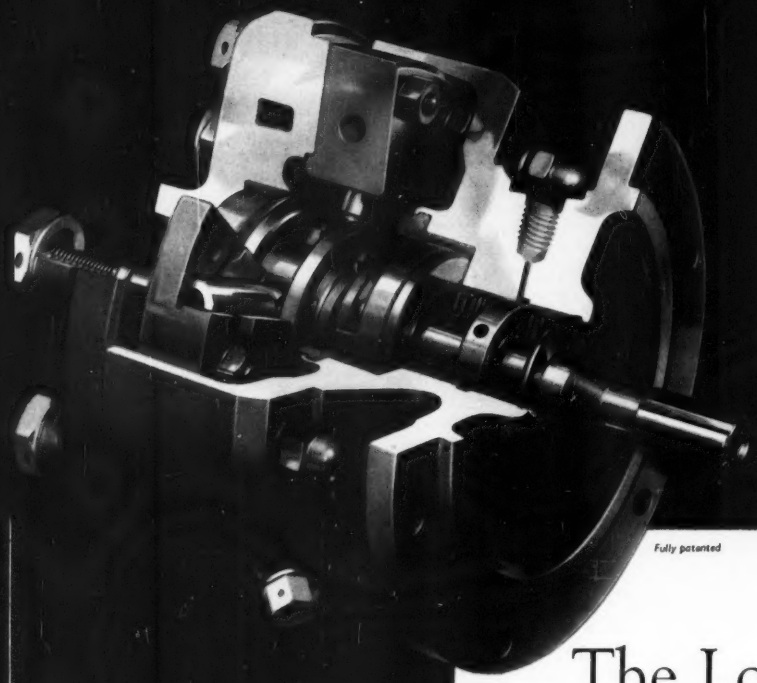

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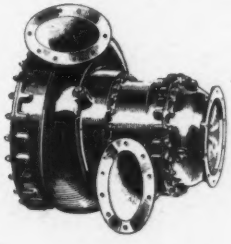

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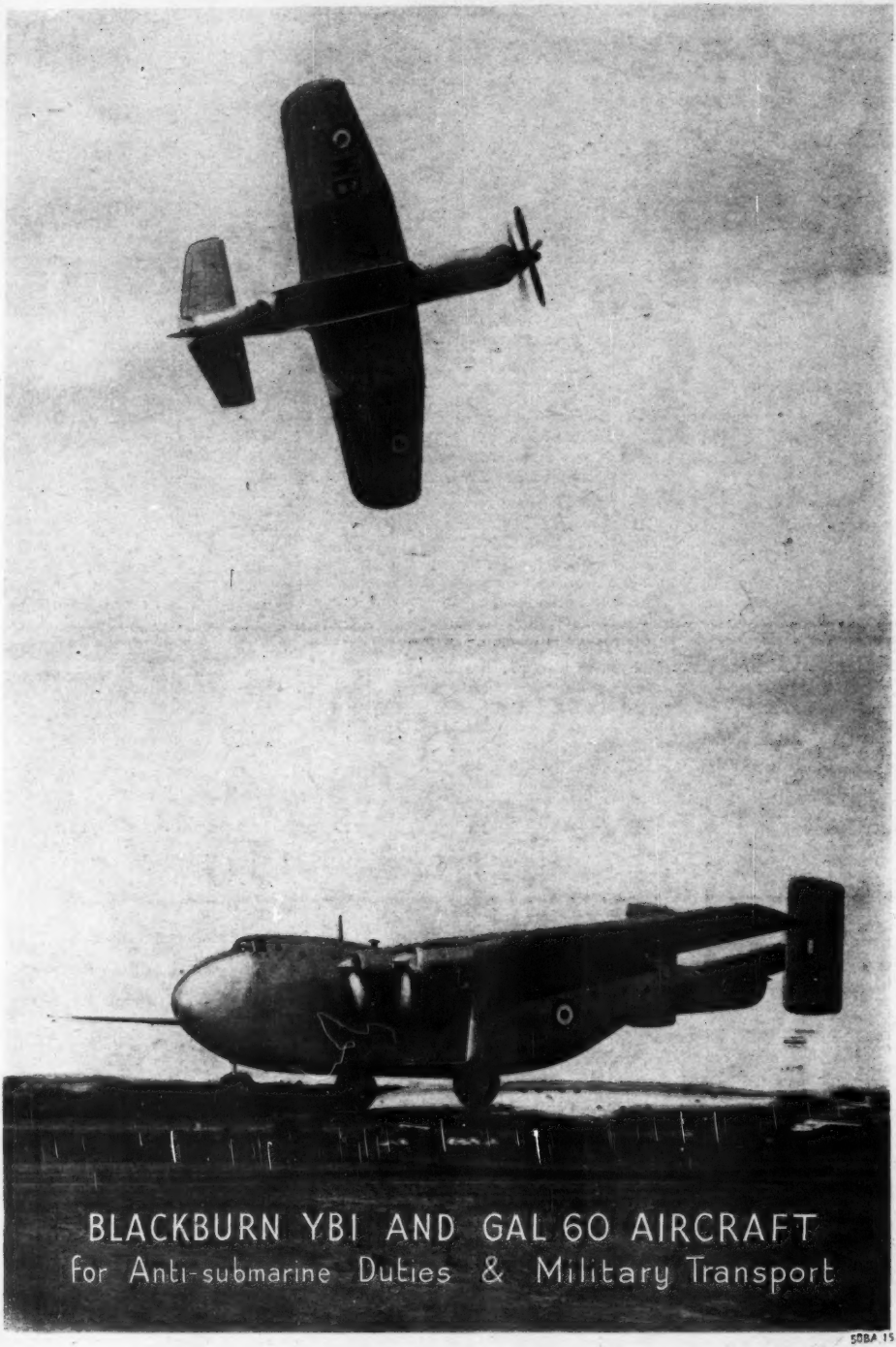
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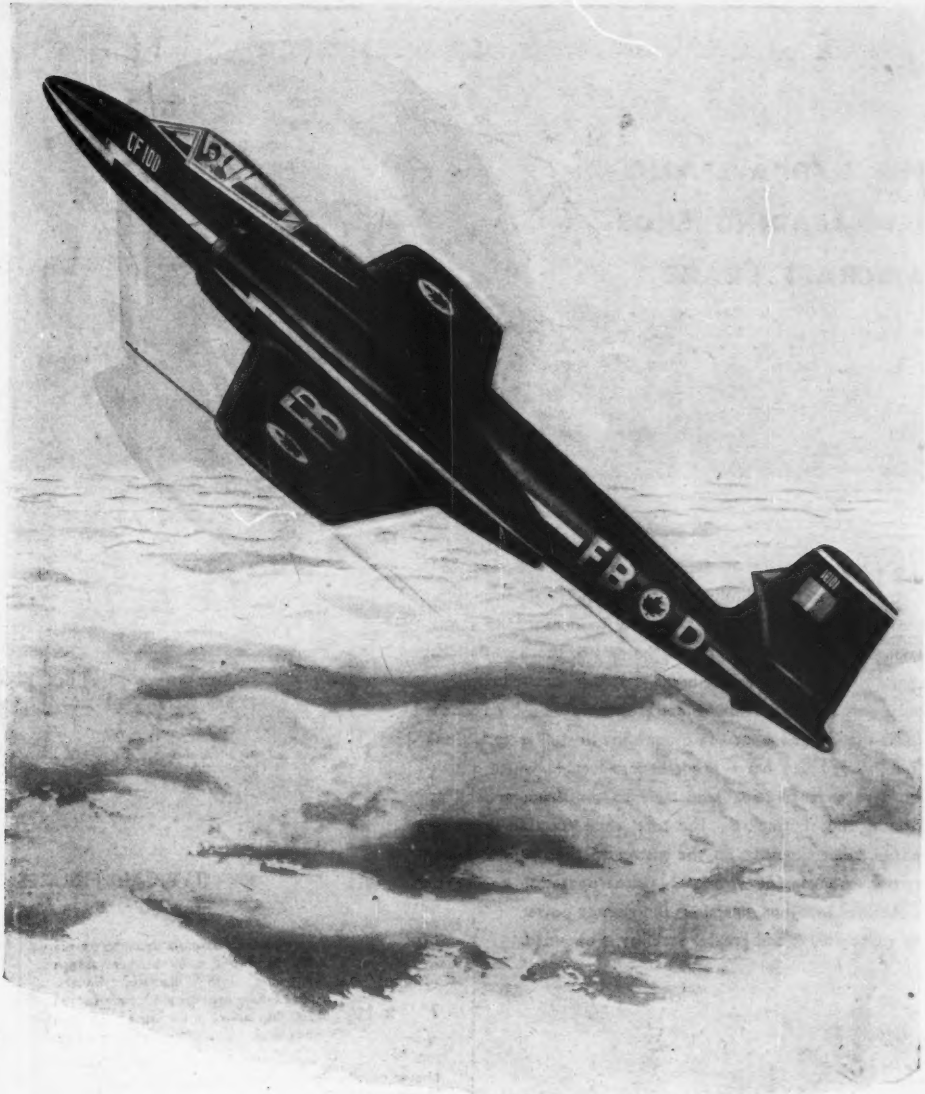

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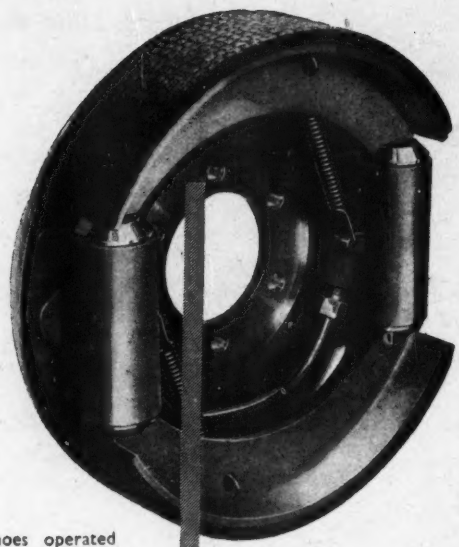

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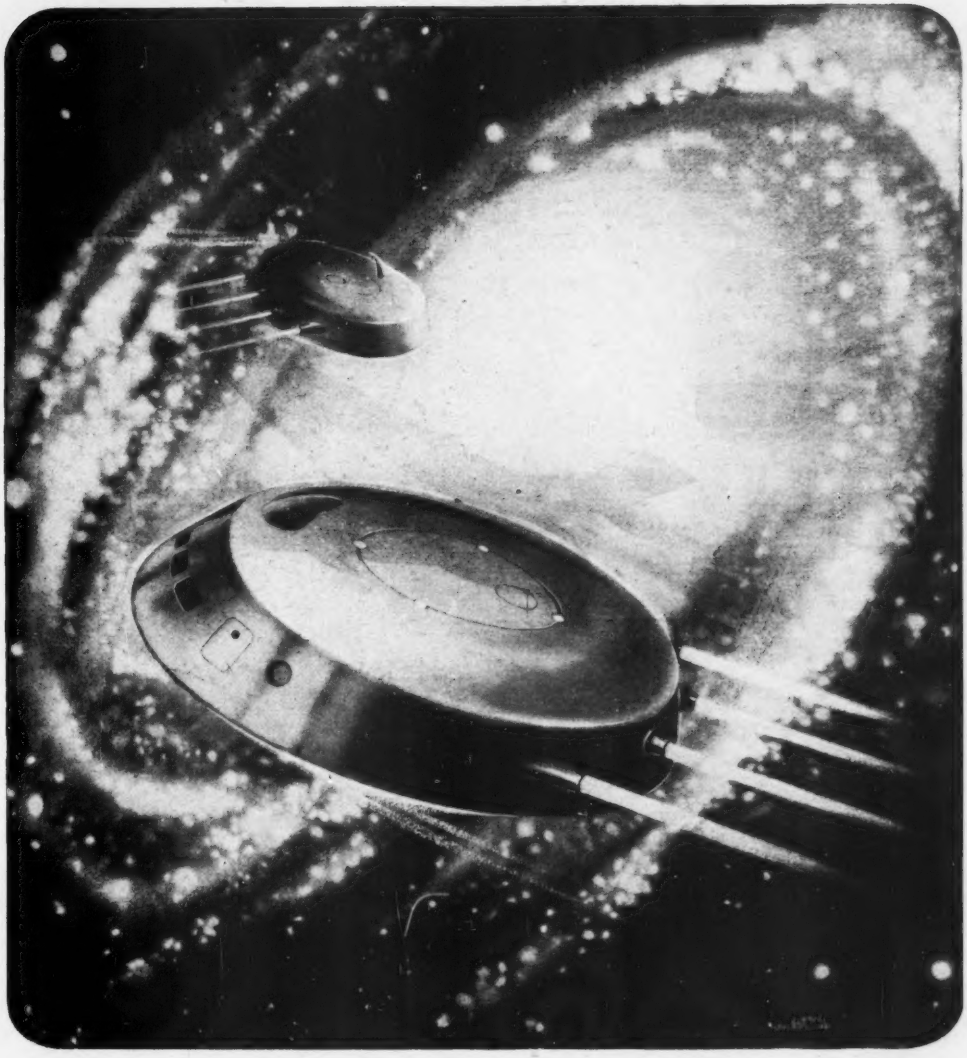

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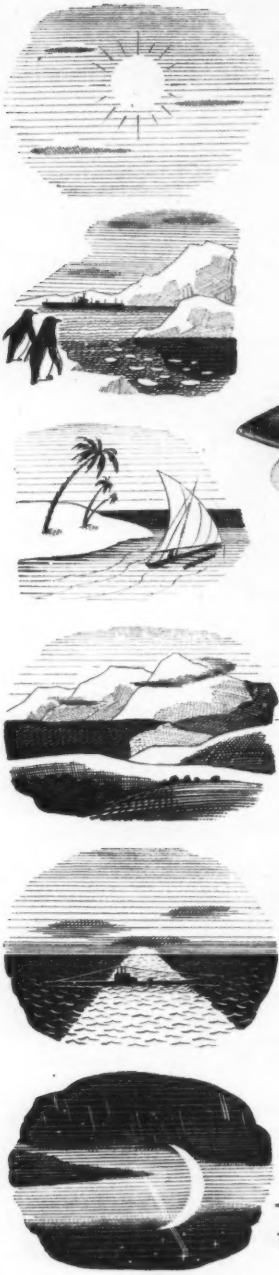

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Founded 1909

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Old Actors on New Stages

IN spite of the fact that B.O.A.C. will quite soon be operating a 500-m.p.h. airliner (the Corporation's first production Comet flew last week), there is no suggestion that a limit to the speed of passenger-carrying aircraft has been reached, nor is one even foreseen. No one seems to have attempted to answer the question "Of what speed can it be said, 'this is fast enough'?" At one time it would have been agreed that physical parameters would alone place a top limit on speed; now it seems probable that for many years to come financial considerations will prove an equally critical factor. Certain it is that speed has to be paid for.

As in the world of fashion, where the few big international houses set the style, so do a few major airlines influence the choice of aircraft to serve on the main trunk routes of the world. The big international operators do not at present see eye to eye on the subject of introducing gas-turbine-powered airliners, though all are agreed that eventually this step must be taken. Yet any good aircraft is likely to make a profit for the next year or two, no matter what type of power unit is fitted. After that, the gas turbine, initially costlier, will probably see off its more sluggish rivals on all operational counts. First cost, though a major consideration in itself, is relatively unimportant by comparison with the ability to operate at a profit; and for this reason it follows that no operator will willingly consider an aircraft, however low its price, if its performance places it in a non-competitive category.

Lower down the scale, among the domestic or provincial lines, the cost of purchasing, introducing and proving new equipment becomes of greater moment; it is here, too, that the aircraft manufacturers face with increasing reluctance the design and development of new medium- and small-capacity aircraft.

It is a sign of the times (and one that may be described as ascendant) that after long consideration B.E.A. have turned to their vintage, though rejuvenated, Dakotas for a further period of service. They have done so for the reason that no other new aircraft has been produced, regardless of cost, which can do the job as well. These Pionairs, as the converted DC-3s are called, are described on pages 67-70 of this issue. At relatively small cost they have been made more comfortable and attractive for the passenger, and more economical for the operator, while retaining their safety and reliability. But, be it noted, they also retain their original engines and are distinctly slow when judged by modern standards. Several American operators of DC-3s are adopting a similar course (we made reference last week to United Airlines' plans).

Existing conditions have led to the waiving of certain of I.C.A.O.'s new requirements in the transport category for three years, when they will be reviewed again. There is little doubt that substantial rebuilds and refits, including re-engining, will become more and more the practice with efficient but ageing aircraft in this class.

To aircraft manufacturers this state of affairs is both a discouragement and a challenge. On the one hand there is much to dissuade them from making any attempt to introduce, unsponsored, a new type; on the other, a really sound basic airframe, once produced, is likely to prove so valuable as to be well worth rejuvenating.

As a further example of how some of the major airlines are thinking there is the growing backlog of orders for another evergreen design—the Constellation. Some 200 m.p.h. slower than at least one jet competitor which will be in service before the current orders can be fulfilled, the Connie is nevertheless a known quantity, "debugged" and with good load and range figures. Its excellent basic design—now to be "stretched," and authorized for a greater all-up weight—may profit by the plans for eventual repowering with turbines and enable it to be lifted into a class not much below that of the pure jets.

Will these rejuvenated Constellations be able to compete in, say, 1955 with Comets in fully-developed form? On the principle of piper-paying and tune-calling, it may well be that the public, by its acclamation of the new generation of airliners as typified by the Comet, will show its approval of the efforts of the more enterprising constructors and operators—and when that happens the less courageous ones will be the losers.

B·O·A·C's FIRST

"Flight" photograph.

The first production Comet takes off on its maiden flight from de Havilland's airfield. It is the third of its type to fly in 18 months.

Production Comet Flies : Bogie Landing-gear Fitted : B.O.A.C. to Train on a Prototype

A SALUTATORY start to the New Year was made by the de Havilland Aircraft Co., Ltd., when the first production Comet was completed and took off on its maiden flight on Tuesday, January 9th. This machine, G-ALYP, is similar to the Ministry of Supply prototypes except for detail alterations and the fitting of four-wheel bogie landing-gear, but, following completion of flight trials, it will become the first to be fully equipped and furnished to B.O.A.C. standards. At the controls, as on the previous two first flights, was John Cunningham, the company's chief test pilot. He remained airborne from Hatfield for 42 minutes, and on landing stated that everything was satisfactory.

John Cunningham checks over details in the crew compartment of the Comet while preparing to fly the first production machine.

Although YP is the first aircraft to be built to B.O.A.C. order, it will not, in fact, be the first to be flown by the Corporation, for the second Ministry of Supply prototype is to be handed over on loan for proving trials and training next month. At the present time it is in the hangar having its main cabin furnished. The forward passenger compartment, galley, and so on, will not be fitted-out on this aircraft. The first production machine, complete in every detail, and with the manufacturer's trials finished, should be ready for the christening ceremony early in June. Comets will probably be introduced into service late this year provided that a sufficient number have been delivered by that time.

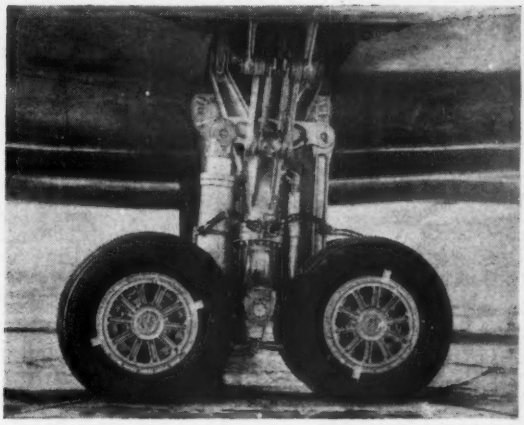
The fitting of bogies is an important step, and, in addition to its primary value in weight distribution, ease of stowage in a thin wing and increased safety from tyre bursts, it has had the incidental effect of reducing landing-gear weight. Some additional stiffening of the wing structure around the large-area wheel-wells has absorbed a portion of the weight gained, but there still remains a positive advantage.

One of the more important changes to be seen on the prototype is the elimination of the horn balances on the tail control-surfaces. Mass balances now form a part of the profile of the fixed surfaces, and they protrude only slightly when the controls are deflected by a large amount.

Such is the importance of the Comet that many readers will be intensely interested in the smallest alteration visible on each new aircraft as it appears. It will be noted, for example, that the spacing of the front cabin windows on the production aircraft is different. This is because on the first two prototypes the windows were positioned to suit the interior arrangements for development and research, whereas now an interior layout for B.O.A.C. has been designed and approved except for small items, and the window positioning altered to suit it. For a somewhat similar reason the portholes above the crew compartment have been eliminated. As all such "holes" in the skin aggravate the pressurization problems it was obviously desirable to do away with them when they were no longer essential.

Originally the small "bumper" tail-skid was retractable. The complication was, however, unjustified, and on YP a fixed and faired skid is fitted.

The small experimental knife-edge spoilers to be seen on prototype wing leading-edges at approximately mid-span have no place on production aircraft. It may not be noticeable, but the finish of the production wings will probably



Details of the four-wheel bogie landing-gear as fitted to B.O.A.C. Comets are clearly shown. The bogie assembly is lighter than a single wheel.
"Flight" photographs

be even better than are the partly hand-made ones on the prototypes. The wheel-well blisters in the wing upper surfaces have also gone with the fitting of bogies, and the wheel doors are of a slightly different shape.

In December, reference was made in *Flight* to the suppressed aerial systems and particularly those developed by the Marconi Company for the Comet. The following details were given:—

"The main fin, which is insulated from the stub fin, is used as an H.F. aerial. In dielectric tips fitted on the fin and tailplane are aerials for V.H.F., O.R.B. and I.L.S. In the case of M.F., a grid aerial is mounted behind dielectric flush panels in the nosewheel doors. Loop and sense aerials for A.D.F. are mounted in the top fuselage and are covered with dielectric flush panels. The I.L.S. glide-path aerial is mounted in the cockpit behind the windscreen, whilst the remaining I.L.S. aerials, D.M.E. and radio altimeter aerials, are mounted behind dielectric panels in the underside of the wing-root fillet." In the heading picture three small dielectric flush panels may be seen on the nosewheel door.

Keen-eyed spotters may, incidentally, have noticed a prototype Comet flying some months ago with one extended jet pipe. This was fitted in the course of normal flight investigations, but the modification did not prove worthy of permanent adoption and was, therefore, discontinued.

Nothing has been announced to date of B.O.A.C.'s views on the use of the two Sprite rocket motors, but more will be known after the rocket motors have been tested in a Comet. However, it is thought to be unlikely that they will be fitted on Corporation aircraft. It may well be that the Comet will not require them, particularly if more take-off power becomes available from the Ghosts. For the time being, however, the fairings for the Sprites between the jet pipes of the paired Ghosts remain. Sprite development, it is learned, will proceed in any case. Ghost turbojets have been under active development for the Comet (as well as for their other military applications) since 1946, and good progress is being made on the bench with liquid injection and towards a higher power rating.

As at January 10th, Comet flying hours were: (1) G-ALVG, 442hr 45min; (2) G-ALZK, 81hr 25min; (3) G-ALYP, 42min. In addition to John Cunningham, two Peters have flown them: one, Peter Bois, is an ex-Transport Command pilot who also flew for a time with S.A.S.; the other, Peter Bugge, Norwegian-born, served with his chief in 85 Sqn., R.A.F., and subsequently became a S.A.S. captain.

B.O.A.C.'s plans for taking over the partially furnished second prototype in February and, later, the production machines as they come off the line, are well advanced Most recent information is that the Comet flight will be based at London airport. Capts. M. J. R. Alderson, A. M. Majendie and E. E. Rodley are now taking a special course on the Comet at Hatfield. After a period of experience and training the first route trials will be undertaken, almost certainly on the London-Rome-Cairo run. Later, and before the introduction of regular passenger services, high-speed mail and freight flights are likely to be made over the route to India. In this way Comets will start to earn their keep before they are carrying passengers on scheduled services.

The introduction into scheduled service of the Comet—the first pure-jet airliner—will mark a great stride forward in airline development, increasing as it does the accepted cruising speed by some 200 m.p.h. and the normal cruising altitude by 15,000 to 20,000 ft. Sensibly, the manufacturers and operators are in complete agreement that there must be no hurrying into service until exhaustive route trials have been successfully accomplished.

A.R.B. NOTICES

ISSUE of the undermentioned *Notices to Licensed Aircraft* and *Notices to Owners of Civil Aircraft* is announced by the Air Registration Board (all are dated January 1st, 1951):—

Notice No. 2, Issue 7: "Supervision of Licensed Aircraft Maintenance Engineers."

No. 4, Issue 8: "Propellers Approved for use on Civil Aircraft."

No. 10, Issue 5: "Ratings of Categories of Aircraft Maintenance Engineers' Licences."

No. 13, Issue 3: "Propellers to drawings Nos. A.66410 and A.66460 fitted to Oxford and Consul Aircraft."

No. 7, Issue 8: "Certificates of Safety."

SOUTH COAST FLYING CLUB CLOSING

PRIVATE-FLYING enthusiasts will be sorry to hear that the South Coast Flying Club, which is based at Shoreham, will cease to operate on March 31st. With a history dating back to 1925, the S.C.F.C. was one of the earliest clubs to be established after the First World War.

After the Second World War it was re-opened by Brooklands Aviation, Ltd., and under the chairmanship of Mr. H. Duncan Davis, A.F.C., has carried on successfully since that date. Mr. C. L. Pashley has been C.F.I. since the early days.

Although the present membership is approximately 150, it has been found that the rising cost of operation has imposed a financial burden which the directors can no longer accept. The site of the club's activities and the club-house at Shoreham are considered almost ideal and it is to be hoped that, through the enthusiasm of local supporters, the S.C.F.C. may yet be given a new lease of life.

HERE and THERE

Canberra Ceremony Postponed

THE christening of the English Electric Canberra by the Australian Prime Minister, which was to have taken place at Biggin Hill last Monday, had to be postponed owing to Mr. Menzies' indisposition. It is now planned for tomorrow, Friday, January 19th.

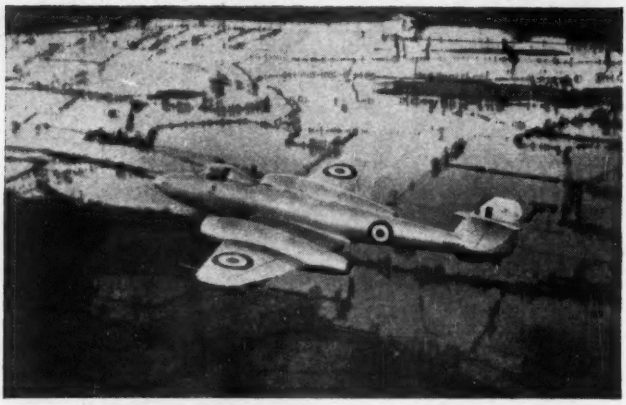
Roman Comets

IT is learned that the B.O.A.C. Comet fleet are not to receive names as such but are to retain their makers' name and a Roman numeral. Thus the first production Comet (referred to on pages 60-61 of this issue) will be Comet I and the rest will carry numbers up to XIV. Whether or not there will be a Comet XIII is not stated.

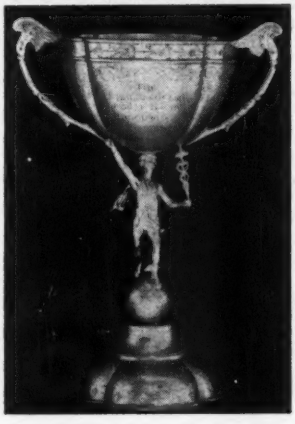
Another B.O.A.C. aircraft, the Bristol 175, has been frequently referred to as the Britannia. This is an unofficial name which B.O.A.C. do not now intend to adopt.

Rally Film

FOR the first time a really comprehensive film is to be made of the Monte Carlo Rally, which starts on January 23rd. The film is being sponsored by the Shell organization and is being produced by Mr. Douglas Rankin, of Faro Films, who will use a Hiller helicopter to film the difficult final stage of the Rally over the Alpes Maritimes, where last year competitors were seriously delayed by snow and ice.



WATER, WATER EVERYWHERE . . . A Meteor P.R.10, long-span photographic version of the Mk. 4 intercepter, flies over flooded Gloucestershire countryside during a recent test-flight from Moreton Valence.



TROPHY: As announced in "Flight" of November 30th last, all the major British air races this year are to be flown at Hatfield on June 23rd, under the title "Festival of Britain 1951 National Air Races." Shown above is the Royal Aero Club Jubilee Trophy, which, commemorating the 50th anniversary of the Club's foundation, will be the principal award in a 105-mile race for all types of over-250 m.p.h. aircraft.

CAMERA-CRANE: The Hiller helicopter from which, as reported above, the Monte Carlo Rally will be filmed. It is seen being flown by Col. Fouchauld, a director of Helicop-Azur, over the Jowett Jupiter which Gordon Wilkins of "The Autocar," and B.B.C. commentator Raymond Baxter will drive in the Rally.

Destructive Supersonics

WINDOWS were broken, crockery smashed and general alarm caused by a "tremendous explosion" in the Los Angeles area recently. The noise was said to have been made by a jet aircraft pulling out of a high-speed dive.

Recognition Classic

AS already announced in these pages, the fourth annual contest for the Aircraft Recognition Society's trophy (a silver model Hurricane) will be held in the Science Museum lecture room next Saturday, January 20th at 4.30 p.m. Over forty teams will be competing, umpired by W/C. Roland Beamont, D.S.O., D.F.C. The trophy will be presented to the winning team by the president of the Society, Mr. Peter G. Masefield, chief executive of B.E.A.

Vertical Expansion

BRISTOL'S huge assembly hall and hangar for the Brabazon prototypes will, it is reported, be converted into a two-storey building to enable work on new defence contracts to take place on the upper floor. As recently announced, the Bristol Aeroplane Company is to supplement de Havilland production by building Venom intercepters. With a floor area of nearly seven acres, the Brabazon building is the largest in the world devoted entirely to aircraft constructional work.

Pooling Experience

FOLLOWING the recent plan for American Service pilots to visit constructors' airfields in this country in order to fly new types comes news that interchange visits by test pilots are also to take place: "Wimpy" Wade, of Hawkers, is now named as the first of the British pilots who will go to America. Liaison of this kind—involving visits by both pilots and aircraft—will, of course, become increasingly essential as equipment begins to be shared by both countries. The Canberra has been flown by U.S. pilots—including Brig.-Gen. Al Boyd—in this country, and one will shortly go to America, while the

HERE AND THERE . . .

Balliol has already visited there. Of Canadian types, American pilots have test-flown the CF-100, while the U.S. Army and Air Force have purchased six de Havilland (Canada) Beavers, two of which are to be tested in Alaska. On the reverse side of the picture, two F-86s are on test here; a number of these fighters—Canadian- and/or American-built—are likely to be supplied to the R.A.F.

Bird-flight Explained

A NEW exhibit contained in four large cases at the Natural History Museum, South Kensington, explains the mechanics of bird-flight. Annotated illustrations and models show how birds take off, fly, glide, hover, dive and land, and skeletons are used to explain their "airframe" structure.

About-face

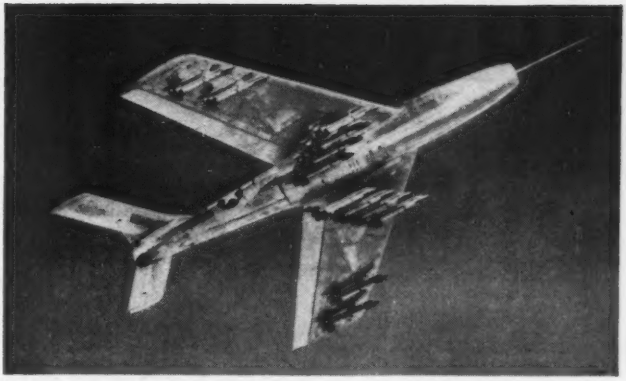
TWO of Japan's leading military-aircraft designers, Saburo Horikoshi and Kiro Honjo, are reported to be working in a technical-executive capacity for the U.S.A.F. at Tachikawa air base near Tokyo. Horikoshi was responsible for the Zero fighter and Honjo for the Betty bomber.

Marstrand Tyre Award

THE Royal Commission on Awards to Inventors has recommended an ex-gratia payment of £2,250 to Maj. O. J. Marstrand, inventor of the twin-contact aircraft tyre. Taken up by Dunlops, who recognized its value for preventing tail-wheel shimmy without restricting manœuvrability, the Marstrand tyre came into general use during the war.

Outsize Transports

THE construction of large semi-rigid or rigid airships to serve as long-distance fuel tankers, or for trooping, is advocated by Mr. P. W. Litchfield, chairman of the Goodyear Tyre and Rubber Co. The U.S. Navy, as is well known, has consistently used small non-rigids—"blimps"—for patrol and training duties. America, also, has a monopoly of the world's helium supply.



TWENTY-FOUR ROCKETS of 5in calibre are seen snugly disposed beneath the swept wings of a Republic F-84F fighter on test at Muroc. This latest addition to the Thunderjet family is faster, has a longer range, and carries more armament than its precursor, the F-84E, now serving in Korea. Span is 34ft, length 38ft, and height 14ft.

PRACTICAL FASHION: London Airport fire-crews are testing a new type of helmet. It is of small diameter, to facilitate ingress through narrow apertures, and has a heat-resistant plastic visor. Designed by the M.C.A. in conjunction with Jas. Hendry, Ltd., of Glasgow, it is made by the latter.

NEWS IN BRIEF

MR. H. A. R. BINNEY, C.B., has been appointed director and secretary of the British Standards Institution in succession to the late Mr. Percy Good, C.B.E.

* * *

The College of Aeronautical Engineering is to hold a dance on February 9th, at the Chenil Galleries, Chelsea. (Tickets from the College Office, 102 Sydney Street, London, S.W.3.)

* * *

"Antisep" water-miscible cutting oil for machine tools, including automatics, is the subject of a brochure from Edgar Vaughan and Co., Ltd., Legge Street, Birmingham, 4.

* * *

Sir Thomas G. Spencer, M.I.E.E., managing director of Standard Telephones and Cables, Ltd., has been elected chairman of the board. He succeeds the late Sir Frank Gill, K.C.M.G., O.B.E., who died last October.

* * *

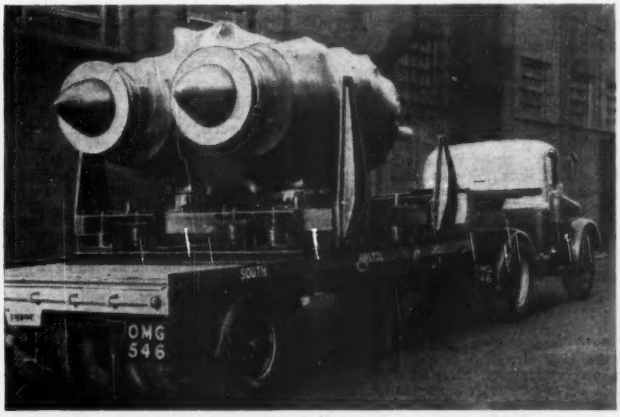
Firms willing to receive visitors at their factories during the Festival of Britain are asked to communicate with Mr. S. D. Cooke, Council of Industrial Design, Tilbury House, Petty France, London, S.W.1 (Victoria 8484).

* * *

Among the names which figured in the New Year Honours list was that of Mr. A. R. Driessen, Eastern Area branch manager for British Insulated Callender's Cables, Ltd. Since 1941 Mr. Driessen has been prominently associated with Air Training Corps activities in the Eastern Counties, particularly in regard to gliding training; he was responsible for the film *Wings for the A.T.C.* He is now District Gliding Officer for the A.T.C. Eastern Area.

* * *

In *Flight* of January 4th there appeared an item concerning Jenolite A.C.1 aluminium cleaner and degreaser, based on information supplied by the makers. They now ask us to state that A.C.1 does not, in fact, carry A.R.B. approval; it is not the Board's practice to grant approval of such preparations, as they do not fall within the class of materials prescribed in Chapter A6-7 of Section A, British Civil Airworthiness Requirements, as requiring A.R.B. approval.



FIT FOR A PRINCESS: Carefully cocooned, the first of the coupled Proteus turboprops for the big Saunders-Roe flying-boats leaves Bristol for Cowes. Each of the three aircraft now under construction will have four coupled and two single Proteus units.

ELEGANCE AND EARNING-POWER are reflected in the graceful lines of the first production Comet, soon to be delivered *(see pp. 60-61).*

CIVIL AVIATION NEWS

THOSE ASSOCIATE AGREEMENTS

A FURTHER meeting was held last week between representatives of B.E.A., the British Air Charter Association and other independent operators to discuss applications to run scheduled services under associate agreements with the Corporation. B.E.A. state that, so far, 116 applications have been made to the Air Transport Advisory Council; of these 45 have been provisionally approved by the M.C.A., 23 were declined and three withdrawn; the remaining 45 are still under consideration.

Meanwhile, the B.A.C.A. will not comment on the routes which have been made available to charter companies until further study has been made to ascertain whether they do, in fact, constitute economic route-patterns. It has been agreed, however, to form an association of B.E.A.'s associate operators in order to standardize operating conditions and effect inter-line working agreements.

At last week's meeting Lord Douglas stated that B.E.A. would not, in future, use chartered aircraft to carry passengers on the Corporation's own scheduled services. "If passenger demand exceeds available B.E.A. capacity on peak days," he said, "short-term associate agreements might be arranged." Lord Douglas thought that the possibility of day excursions to the Continent without passports would influence this arrangement.

ANGLO-INDIAN DISCUSSION

THE M.C.A. delegation which, led by Sir George Cribbett, the Ministry's deputy secretary, is visiting India to discuss the conclusion of a bi-lateral agreement between Britain and India, reached New Delhi last week; negotiations began on January 11th. Existing air services between the two countries, which are flown by B.O.A.C. and Air India International, are governed by temporary arrangements which the two governments are now seeking to make permanent. Discussions with the same object were held between the two countries last July but failed to produce results. At that time, the main difference of opinion concerned the capacity of the proposed services. It was followed by an exchange of letters embodying the present arrangements.

RUSSIA'S EXPORT BID

IN South America, it appears, the United States civil aircraft industry is encountering opposition from an unexpected quarter. Agents of the U.S.S.R. are reported to be attempting to find a market there for two types of Russian transport which are being offered at remarkably low prices.

Although not quite as elaborate as its nearest counterparts in Western countries, one of them, the widely used Il-12, a twin-engined 40-seater, is nevertheless considered "in the Convair class" and European pilots who have flown the machine are said to think highly of it. The price quoted is $125,000 (about £44,640), fly-away Prague.

The second type being offered, the Yak-16 feederliner, threatens to be a blow to the prestige of the U.S. aircraft industry, which has produced nothing in this category for over ten years. Powered by two 620 h.p. ASH-21 seven-cylinder radials, the Yak-16 cruises at 170 m.p.h. and can accommodate ten or more passengers plus a crew of two; gross weight is 14,100 lb. At $40,000 (approximately £14,285)—which the Russians have said they will accept in soft currency or barter—this type may be highly acceptable to Latin American operators.

NOBLESSE OBLIGE

IN the December issue of *The Log*—the official journal of the British Airline Pilots' Association—there appeared a contribution by the Association's chairman, Capt. A. le R. S. Upton, who pointed out the need for pilots to uphold their professional status by always being smartly dressed, by obtaining, if possible, accommodation in the same hotel as passengers and by always conducting themselves with dignity both on and off duty.

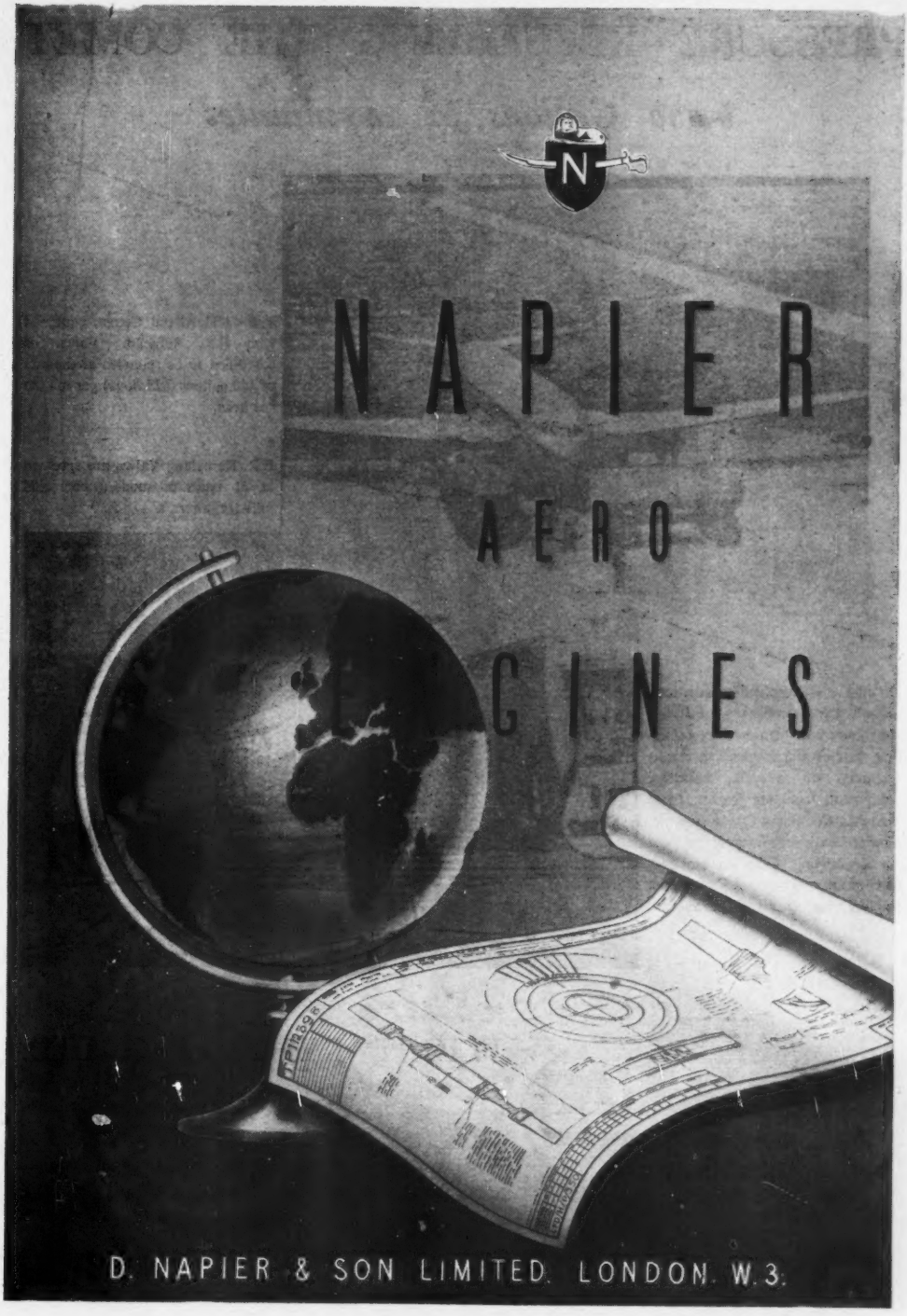
The article has since evoked criticism from at least one captain who, writing in the current issue, considers it "quite wrong to assume" that it is by their neglect of these points that pilots have lost status. He maintains that the Corporations' policies (in particular, that of B.O.A.C.), have been aimed at deliberately lowering status. He demands that B.O.A.C. should consider an immediate return to the pre-war system whereby an aircraft commander and his first officer were conveyed between airport and hotel by saloon motor-car. The Corporation should also be asked, he says, to provide first-class accommodation, i.e., a room with a bath at a "four-star" hotel. Pilots, he thinks, should receive an overseas allowance of £2 per day to enable them to "uphold their dignity and move in the right circles."

In addition, he avers that the modern tendency towards "the obedient pilot-receiving his instructions through control-towers, Officers i/c Training, Line Standing Orders and Crew Notices" lowers the status of pilots, so that they may become "moronic" and "in the end endanger lives through their own inability to make a decision." Finally, he is of the opinion that an aircraft captain should never be required to submit himself to check-flights which, he claims, "tend to undermine the captain's confidence in himself and endanger discipline in the aircraft."

These controversial matters would undoubtedly form an excellent subject for a debate, although among the pilots on *Flight's* staff, at least, there is agreement on several important points. For example, it is unquestionably desirable in every way to uphold and enhance the position and prestige of the airline captain. We have no evidence to support the contention that the B.O.A.C. policy has been to lower the status of the pilot. We are well aware, of course, that standards of accommodation and allowances for crews have on occasions left something to be desired, but this is an inevitable result of essential economizing on the part of a nationalized Corporation. We congratulate B.O.A.C. executives on their administration of one of the few nationalized concerns to consider the taxpayer at this time; and we believe that in return the public will wish standards of crew accommodation to be improved as soon as the Corporation is out of the red. The sooner the captain is able to mix socially with his passengers on the ground as well as in the air, and be held in the same esteem as is the captain of an ocean liner, the better it will be. His officers' prestige will also rise.

The pilot quoted above will find himself in the minority regarding the receipt of orders from the ground—we refer him to a letter from a Sabena pilot in *Flight* of November 16th, 1950, as one example of the growing feeling upon these matters. But let us be sure that those who give instructions to captains from control towers and so on are fully competent to do so—that they are retired (from flying) senior captains, for example.

Finally, in regard to submitting to check flights, surely some qualification of the statement is required—certainly all pilots, civil or Service, hate being tested. Captains do not, we believe, require routine checking in normal flight manœuvres (though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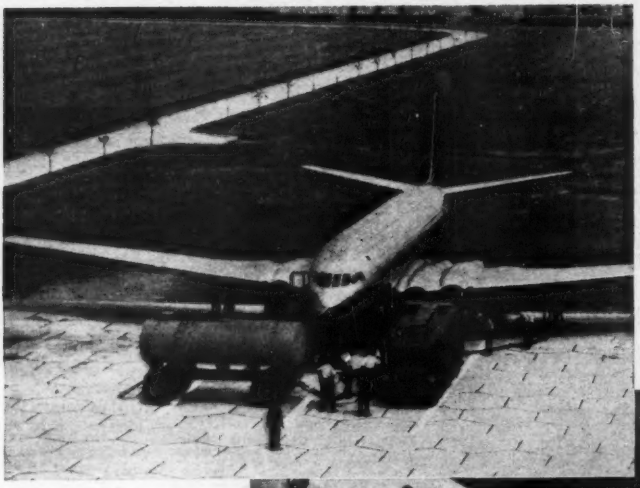

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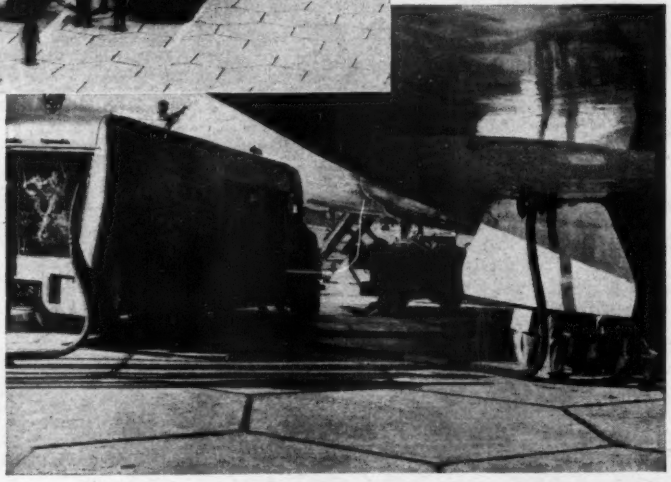

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CIVIL AVIATION NEWS . . .

even the best can unconsciously acquire a bad habit); but in all emergency drills and procedures, as well as in engine-out flying, regular practice is obviously to be recommended for captain and crew. If self-confidence appears to be undermined and discipline endangered by such measures, some quite different contributory cause should be sought. Every pilot cannot be a born leader, but he can achieve commendable results in his crew by his personal efficiency and the example he sets.

A YEAR'S CHARTER TRAFFIC

BROKERS on the Baltic Exchange report that the past twelve months have witnessed a continued expansion of the air freight market and that the tendency has been felt over a widening field of operations.

One of the most notable increases was that seen in the number of charters concluded for the movement of ships' crews. This is thought to have resulted partly from shipowners' ready appreciation of the great saving in time and money which the use of air transport can effect and also from the close contact which the Baltic Exchange makes possible between the charterer and the broker.

The majority of this type of traffic last year plied between Britain, India and the Far East. The number of seamen involved in each charter, normally 35 to 50, usually meant that this traffic was limited to larger aircraft, with the result that in many instances the regular airlines could offer competitive rates. At the same time, it is said, there was no lack of short-haul business, and in this sphere the charter companies were at their greatest advantage, as the numbers of seamen to be moved were usually suitable for machines such as Vikings and Dakotas.

In particular, Scandinavian buyers of new British ships sent their delivery-crews by chartered aircraft.

Deliveries by air of essential spare parts—of which carriage by surface transport might have meant that a ship was out of commission for some weeks—included such heavy loads as a seven-ton tail-shaft from Amsterdam to Mauritius, a 4½-ton rotor from Abadan to Amsterdam for re-winding (after which it was re-delivered to the Persian Gulf) and a 4½-ton rudder stock from Prestwick to Singapore.

During the year, also, a number of chartered companies were engaged on contract work which involved the movement of servicemen and civilians, with their families, to posts overseas.

Pilgrim flights to Rome and a number of inclusive tours to—among other places—Austria, the South of France and Corsica, also contributed to the overall increase seen in the charter business.

Freight operators found that some of their most common loads were textiles, flown from France to the United Kingdom. There was also a steady traffic in chemicals from this country to Northern Italy. During the latter part of the year the Corporations made use of their larger charter aircraft to augment their freight services to Singapore and Hongkong and to fulfil certain Government commitments.

The brokers consider that charter companies should be assured of high utilization and continued employment this year.

BREVITIES

BECAUSE bad weather has delayed work on certain radio installations, the M.C.A. has had to defer until February the introduction of Phase II of the British National Airways system.

* * *

P.A.A. announced last week that their Atlantic Division carried a record total of 69,767 passengers on transatlantic routes last year. Of this figure, 37,464 passengers travelled in the westbound direction, most of them passing through the company's terminal at London Airport.

RECORD-BREAKER: Subject to confirmation, a new altitude record for light aircraft has been established by Miss Caro Bailey, of Miami, who recently attained 30,380ft in a Piper Super Cub; this height was reached after five hours' flying. During the war Miss Bailey served as a W.A.S.P. with an American target-towing squadron.

Much missed by the delegates at future I.C.A.O. conferences will be Mr. A. R. McComb, the organization's deputy secretary-general, who has announced his intention of resigning in order to return to the service of the Australian Government. As a representative of Australia he was one of the first members of the I.C.A.O. Council.

* * *

On January 10th the Avro Jetliner flew from Chicago to New York in 1 hr 42 min. This 700-mile route—which conventionally-powered aircraft normally cover in 2 hr 50 min—was flown at an average speed of 410 m.p.h. The flight established a new U.S. speed record for transport aircraft.

* * *

Last year Aer Lingus carried a total of 222,500 passengers—an increase of 30,000 on the previous year. With a total of 105,625 passengers the Dublin-London route was, as usual, by far the busiest. Freight showed a rise of 37 per cent on the 1949 figure.

* * *

S.A.S., it would appear, shared in the world-wide improvement in air traffic last year. Figures for 1950 operations show that 429,000 passengers travelled in aircraft of the three companies, D.N.L., D.D.L., and A.B.A., which together comprise the Scandinavian Airlines System.

* * *

United Air Lines are now using a novel method of training sales staff. Over-the-counter and telephone conversations between customers and the company's personnel are electrically recorded and later played back to the employees by an instructor, who points out any defects in their technique. United's sales manager, Mr. B. Gragg, is convinced that one recording is "worth 10,000 words" of oral or written instructions.

* * *

The rapid growth of air freight traffic in Australia is clearly seen in A.N.A.'s figures for the year ended June 30th, 1950. The total freight lifted was over 58,000,000 lb, which is an increase of 44.6 per cent over the figure for the previous year and, when considered on a *per capita* basis, constitutes a world record. A.N.A.'s operations now exceed 49,000 aircraft-miles per day, involving 160 flights.

* * *

A figure formerly well known in Scottish aviation, Mr. George Nicholson, has died in Johannesburg at the age of 43. He was famed as the founder of the Scottish "air ambulance" service 16 years ago. In November, 1934, he inaugurated a service from Renfrew to Campbeltown and Islay and was subsequently responsible for much of the development of Renfrew airport. From 1945, until his resignation in 1947, he was manager of B.E.A.'s Scottish Division.

* * *

Aircraft movements at British airfields during November totalled 25,278, the proportion of transport movements being 3 per cent higher than last year's figure. Commercial

CIVIL AVIATION NEWS

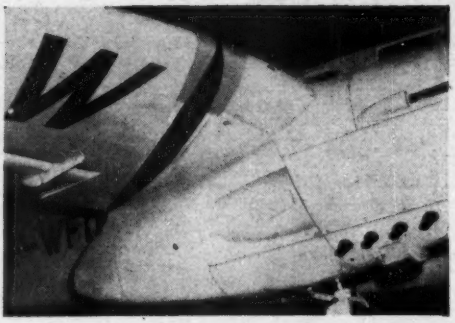
passenger movements reached 101,114, and 2,511 tons of freight were handled. The freight figures represent an increase of 34 per cent over the total for the corresponding period of 1949. London and Northolt again accounted for nearly two-thirds of all passenger movements. The next busiest passenger airports were—in order of importance—Prestwick, Belfast and Glasgow.

* * *

Statistics published by Panair do Brazil for operations in 1950 show that nearly 11,000,000 miles were flown and over 250,000 passengers carried. Freight lifted amounted to some 6,000,000 kg. With the inauguration of several routes which are planned for the near future, the company's network will be extended to 97,374 km—the sixth longest in the world.

* * *

The first production version of the S.E.2010 Armagnac made its first test flight on December 30th. The second production aircraft has also been finished and is expected to fly shortly. Fifteen machines of this type are already on order—eight of them destined for Air France and six more for the Compagnie des Transports Aériens Intercontinentaux. Incidentally, the experimental Nene-powered S.O.30 Bretagne has now been delivered to the S.N.C.A.S.O. test-flying establishment at Villacoublay for trials in the immediate future; it is expected to have a maximum speed of 750 km/hr (approximately 468 m.p.h.) at 30,000ft. Take-off weight is about 38,000 lb.



WINGS ON SPRINGS: Clearly seen in this close-up is the oblique, faired-in hinge-line of the variable-incidence wing used in the French Rey 01, which, as recorded in "Flight" last week, recently made its first flight. An elastic-linkage system allows the wing to vary its incidence automatically in turbulent air, but the pilot has an over-riding control. Two 220 h.p. Renault engines provide the power.

FROM THE CLUBS

ON December 21st the Wolverhampton Aero Club held its annual dance at the Wulfrun Hall, Wolverhampton, and 250 members and guests spent a very enjoyable evening. The Mayor and Mayoress of Wolverhampton were the guests of honour, while other visitors included civic dignitaries and the president of the Derby Aero Club.

During the evening several cups, offered by the members for annual competition between club-members, were presented. The Ductility Trophy, which is awarded annually to the member judged by the flying committee to have achieved the most outstanding performance during the year, was won by Mr. D. Jemmett, a consistent air-race competitor and owner of a Hawk Trainer.

Several W.A.C. members participated in the National Air Races held throughout the country last year, while twelve of the club's aircraft took part in the Deauville rally and five attended the gathering at Cognac in July.

* * *

COMPARED with the figure for previous months, the total number of hours flown during December by the Strathtay Aero Club was low. This was primarily due to adverse weather —in spite of which, however, a considerable amount of dual was given and a number of keen (but by now somewhat impatient) pupils are ready to be launched on their first solos.

The A.T.C. Flying Scholarship Scheme has been in operation for six months and during this period fifteen cadets have completed the course and have qualified for their licences.

The nine Saudi Arabian students attached to S.A.C. for instruction on Tiger Moths have all reached P.P.L. standard and are now being given advanced training on Proctors.

GLIDING SAFETY

AS mentioned in *Flight* last week, the Ministry of Civil Aviation has issued a summary* of notifiable accidents involving British aircraft during 1949. Nine such accidents occurred to U.K.-owned or registered gliders, of which two were fatal. They were classified as follows: Error of launching personnel and damage during premature launch caused airframe failure during take-off (1); too-steep climb stalled winch (1); stalled in turn on approach (2); collided with cables on approach (1); stalled in steep turn (1); other causes (3). Other accidents doubtless occurred, but did not come within the notifiable category.

Readers may recall that early in 1950 London Gliding Club decided to discontinue insurance (other than compulsory third-party) on their aircraft, on the grounds that the high premiums made it uneconomic to insure. From then onwards the club was carrying its own risks, and accordingly took drastic steps to tighten-up on flying instruction, flying discipline and airmanship. The high premiums being asked by insurance companies were not confined to the London Club and, indeed, the companies' experience of glider accidents in general made them hesitant to accept any proposals except at very high premiums. Even allowing for the higher standards of pilots competing in contests, companies were unwilling to accept the risk of temporary contest-coverage. In an attempt to meet this situation, certain interested groups and individuals are now trying to obtain lower premiums by producing proof of consistent accident-free flying, although an alternative solution would appear to be a continuance of the existing high premiums, but with a correspondingly generous "no-claims" bonus.

Most accidents involving gliders are avoidable, and many accidents which do occur may be attributed to slackness in training, non-observance of flying regulations and failure to practise (mostly elementary) principles of airmanship. These are matters within the province of the gliding clubs themselves, and seldom affect the relationship between the gliding movement and outside bodies. In the past year or so, however, the B.G.A. has entered into a number of agreements with the M.C.A., as a result of which clubs have been singularly free from Ministerial regulations and restrictions. The removal of such restrictions has generally been conditional on the adoption, under the auspices of B.G.A., of certain recommended standards and practices. It is obvious that the M.C.A., in relaxing its control, acted in the good faith that the practices recommended would be enforced by the B.G.A. The latter, on its part, obviously expected that clubs would appreciate the valuable concessions gained by B.G.A., and accordingly conform to the standards.

Unfortunately, theory has not accorded with practice, and some clubs and others have not fallen in with the spirit of B.G.A.'s negotiations. In other words, the standards are not being observed and enforced with the unanimity which is essential if the Association's relationship with the Ministry is not to be jeopardized.

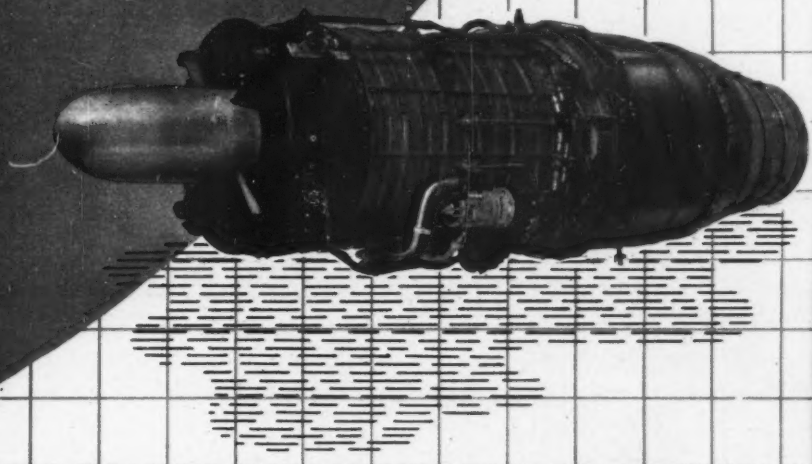
In the case of agreements negotiated with the M.C.A., failure of clubs and others to observe B.G.A. standards may result in concessions being withdrawn and clubs again being required to conform to M.C.A. and A.R.B. standards, enforceable at law. In the case of regulations laid down by the Association itself, non-observance leads to lower standards all round and makes a mockery of the whole B.G.A. organization (which, after all, is made up of the clubs themselves); and it brings a corresponding danger of the present accident-and-damage rate continuing and eventually placing gliding out of reach of the average man, who cannot afford to support unproductive waste. If gliding is to progress, wasteful slackness must be eliminated.

The enforcement of B.G.A. regulations relating to C.s of A., instruction and operations is obviously the concern of clubs. However, individuals who gained their "C" gliding certificates prior to the agreement between B.G.A. and M.C.A. might profitably spend a little time in these winter months studying the summary of flying regulations issued by B.G.A. under the title *Oral Examination for the "C" Certificate.* M. E. P.

* M.C.A. Publication 89: "Accidents to Aircraft of the United Kingdom." Price 9d, H.M. Stationery Office.

ARMSTRONG SIDDELEY GAS TURBINE DEVELOPMENT

already 7,200 lb. thrust



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PIONAIR

New Life for the Dakota — B.E.A.'s Economical Conversion : Greater Passenger-comfort : Standardized Instrument Layouts

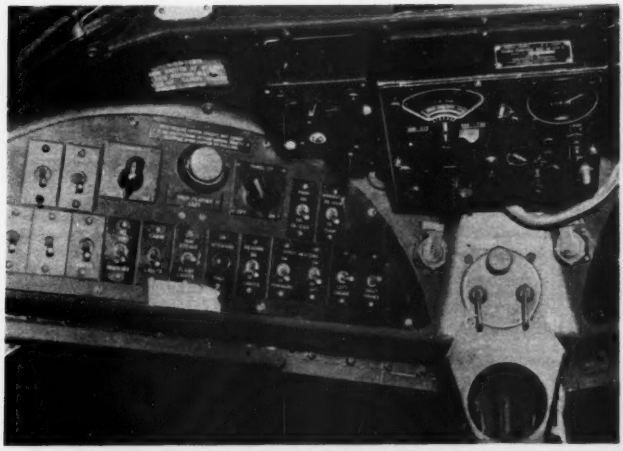
Illustrated by "Flight" photographs

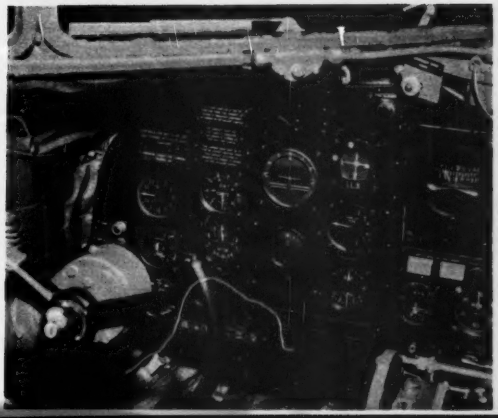
The new downward-opening stairway-door and luggage-loading hatch

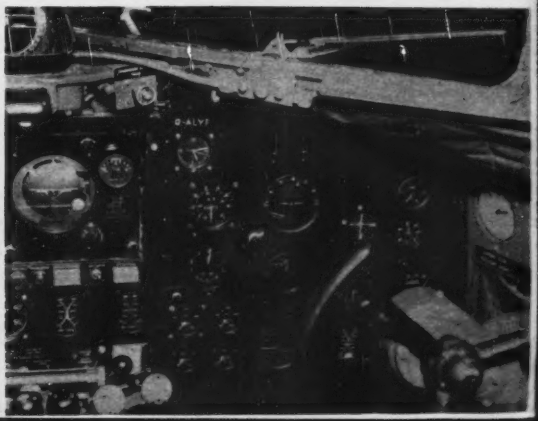
IN the life of every transport aircraft there comes a time when its operator has to think, if not of replacing it by a more competitive type, then at least of how it may best be adapted to take full advantage of the changing traffic-potential of the routes on which it is used. In the case of British European Airways Dakotas, which are used mostly on comparatively short stages within the British Isles (and of which, for financial reasons, replacement is not contemplated for at least another five years) the problem was not one of increasing capacity to any large extent: it was mainly a question of generally improving the aircraft to reduce operating costs while at the same time providing a flexible seating layout which would lend itself to quick conversion to higher passenger-capacity when necessary.

It was towards the middle of last summer that B.E.A. first announced their intention of giving a new lease of life to their Dakotas. The work of overhaul and modification, undertaken by Scottish Aviation, Ltd., at Prestwick, began during the winter months and the prototype Pionair, as B.E.A.'s DC-3s are now styled, is already complete.

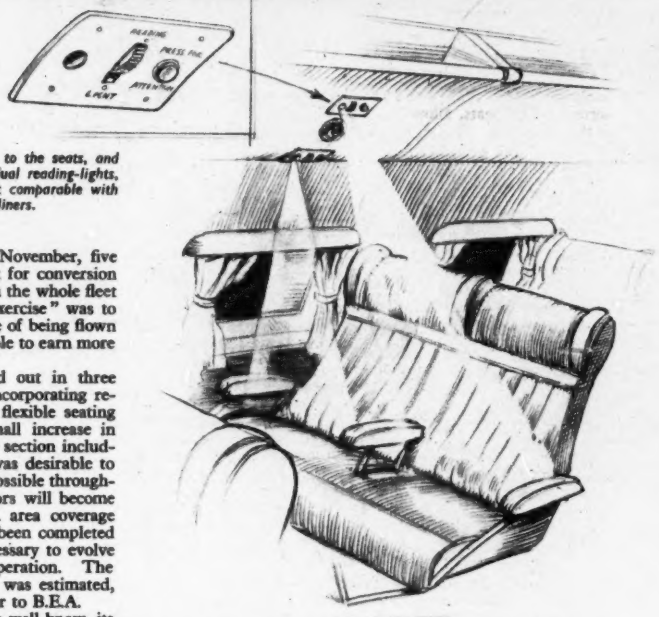
Composite presentation of the cockpit layout. The use of dual-needle engine instruments has made room for an almost complete blind-flying panel in the second pilot's position. The only omission is the rate-of-climb indicator, which has been replaced by an I.L.S. meter. All warning lights have been mounted on a single strip in the centre panel between the A.3 Gyropilot and the boost and r.p.m. indicators. In the centre of the re-arranged roof-panels are seen the control units for (left) the Marconi beam-approach system : (centre) the Bendix radio compass and (right) the M.F. receiver. In the extreme right-hand view is the aerial-loading adjustment.







PIONAIR . . .



The addition of head-rests to the seats, and refinements such as individual reading-lights, give a measure of comfort comparable with that of many larger airliners.

Briefly, the plan was that, beginning in November, five aircraft each month should go to Prestwick for conversion so that before the 1951 summer season began the whole fleet would be complete. The "object of the exercise" was to make the Dakotas more comfortable, capable of being flown by a smaller crew, cheaper to operate and able to earn more money.

The Pionair conversion is being carried out in three phases, to give (a) a standardized cockpit incorporating refinements and improved layout; (b) a more flexible seating and freight arrangement allowing for a small increase in seating capacity; and (c) a standardized rear section including galley and toilet. In the first place it was desirable to standardize instrument layouts as nearly as possible throughout the B.E.A. fleet, and as wireless operators will become superfluous upon the completion of V.H.F. area coverage over the British Isles (this has now, in fact, been completed except for the Snowdon station) it was necessary to evolve the most suitable layout for two-crew operation. The change-over to two-crew working would, it was estimated, result in the saving of nearly £100,000 a year to B.E.A.

As those who are familiar with the Dakota well know, its cockpit has always borne some resemblance to a Christmas tree, its miscellany of controls and dials seemingly being littered around the panels rather than positioned with the object of making the pilots' job easier. To supervize the planning of the revised instrument layout, B.E.A. appointed Capt. A. Appleby, who was made responsible for collecting and evaluating the ideas of the Corporation's pilots on the subject.

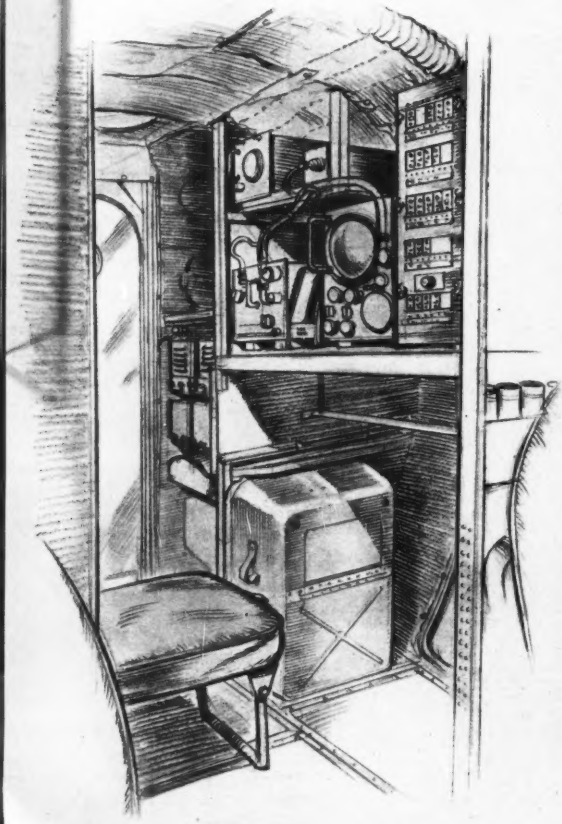
It was decided that the co-pilot should have a full blind-flying panel instead of merely an A.S.I. and altimeter as fitted previously; to provide space for this modification, it was necessary to use dual-needle engine instruments fitted below the A.3 Gyropilot in the centre panel. In addition, the co-pilot was to have an extra I.L.S. presentation so that the aircraft could quite literally be flown from either seat.

Other detail alterations apparent in the finished layout are as follows: the location of the r.p.m. and boost gauges has been reversed to correspond in the natural sense with the position of the throttle and airscrew controls. The left-hand panel has a normal British blind-flying layout, except that, by lowering the position of the rate-of-climb and slip-and-turn indicators, space has been gained for an I.L.S. meter now mounted to the right of the gyro-horizon. A radio compass and the radio altimeter are found at the extreme left of the panel; the co-pilot has an additional radio-compass indicator.

Fire-warning lights have been removed from their former rather obscure location in the roof panels, and refitted in the top inboard corners of the pilots' panels. All warning lights have been repositioned on a single strip below the auto-pilot and the old flap indicator has been exchanged for a Desynn-type instrument which is now mounted on the captain's panel. Fuel guages have been moved to the right of the first officer's panel, where they occupy the space formerly taken by the undercarriage warning-lights.

All radio units have been fitted in racks behind the captain's seat and arranged in such a manner that when adjusting radio equipment or viewing the Gee presentation a crew-member may use the new jump-seat, which opens into the alleyway. Particular attention has also been paid to instrument lighting and to the rearrangement, in a more accessible pattern, of the numerous switches located in the pilot's roof panels.

The radio communication equipment to be carried in the Pionairs consists of S.T.R. 12A and S.T.R.9 V.H.F. units, channelled through Ultra station-boxes conveniently



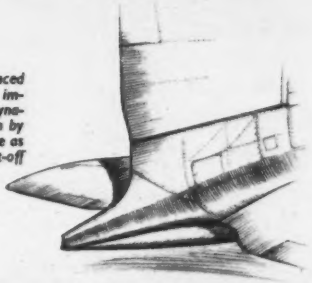
The folding jump-seat has been positioned for use when the second pilot is operating the Gee unit or by a radio officer using a removable W/T set, which would be installed beneath the main radio rack.

mounted in the roof to the left and right of the first and second pilots' seats, allow three radio services to be used at the same time. So far as aids are concerned, the Pionairs are to be fitted with I.L.S., Gee, and S.B.A., with an M.F. receiver for radio beacons. The first machine to be converted also carries a radio altimeter, but it is understood that this instrument will not necessarily be fitted in all aircraft. Provision has been made for the carriage of a portable H.F. W/T. set in the forward entrance space under the main radio rack. It is required on those Continental—particularly German—routes upon which a radio officer (using the jump-seat) would be carried.

The conversion to two-crew operation has enabled the bulkhead between the passenger compartment and the former navigator's position to be moved forward to make room for an extra row of seats. Two more windows are provided, and from them a particularly good view over the wing leading-edge may be obtained.

There are now seven complete rows of leatherette-upholstered double seats which, being fitted with comfortable head-rests, represent a great improvement over the old type. The fact that the extra seats could be introduced at the front end of the fuselage has made possible the installation of a removable galley just forward of the main entrance-door on the port side of the cabin. When the aircraft is used on high-density routes the galley is easily taken out and the frame bulkhead of the baggage compartment opposite moved back to make room for still another row of seats on each side.

A major improvement is seen in the stowage for luggage or freight, which will normally all be carried in the after-holds, the forward placing of the passenger load having produced the correct c.g. position without the need for stowing any luggage in the front compartment. The frame bulkheads, tastefully covered by curtains in B.E.A.'s new grey tartan material, are adjustable to make five bag-

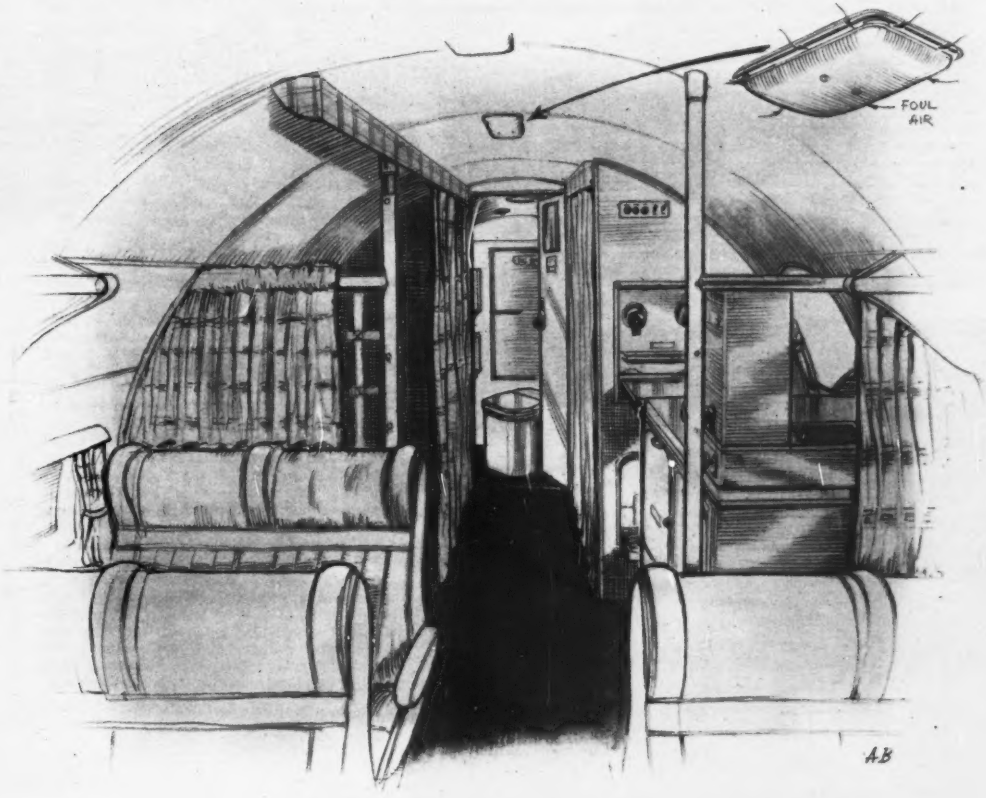


In addition to enhanced appearance, a slight improvement in aerodynamic efficiency is given by the new long tail cone as compared with the cut-off tail of the Dakota.

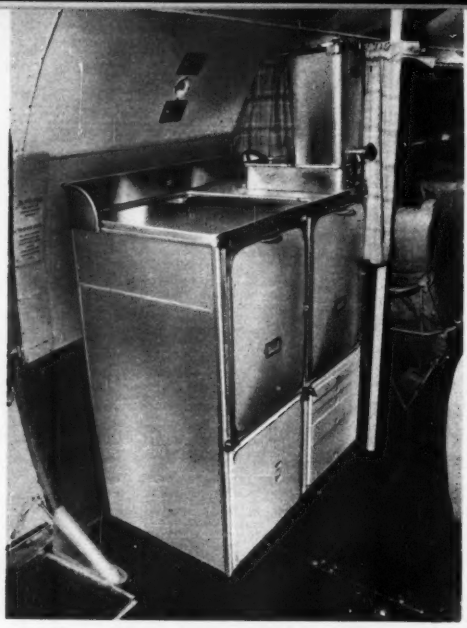
gage or freight holds with a capacity of up to 2,270 lb.

Perhaps the most striking feature of the Pionair—and one which is particularly gratifying from the ground-handling aspect—is the provision of a downward-opening main door with integral passenger steps and handrails somewhat similar to those already fitted by some American operators. The door is light, and easily closed from the cabin; on opening its fall is cushioned by a hydraulic damping device. To the rear of the passenger steps a large luggage hatch has been fitted; situated at a conveniently low level for ease of loading, it carries a removable guard-rail to prevent stacked luggage from falling out when the door is opened.

Immediately to the right of the passenger entrance is the forward bulkhead of the port freight compartment and upon it are mounted, almost flush, a folding seat and folding table which, together with a panel of call lights, constitute the new flight attendant's station. In the extreme rear of the fuselage a luxurious Viscount-style toilet compartment has



(Below) The after end of the cabin is exceptionally well appointed. Movable frame-bulkheads which form the three rear luggage-holds are covered with curtains in B.E.A's new tartan material : the Viking-style toilet is neat and spacious.



The light buffet galley, equipped with two G.E.C. liquid-heating canisters can be removed for high-density-route operation, to make room for two extra seats.

PIONAIR . . .

been provided, access being *via* the curtained passage between the port and starboard luggage-holds.

Among other improvements are standardized heating and de-icing systems with hot-air extensions to the steward's station and the toilet compartment. One noticeable exterior modification is the fitting of an extended tail-cone.

As each Dakota goes in for conversion it is given a complete overhaul which in some cases involves extensive re-skinning of the underside of the fuselage. The floor structure has been lightened and re-designed. Although it was originally intended to use wood for some of the interior panelling, it was found that it would have added too much weight; interior furnishing is therefore executed to a large extent in soft grey fabric which, in combination with the brighter lighting system, gives a pleasing impression of spaciousness.

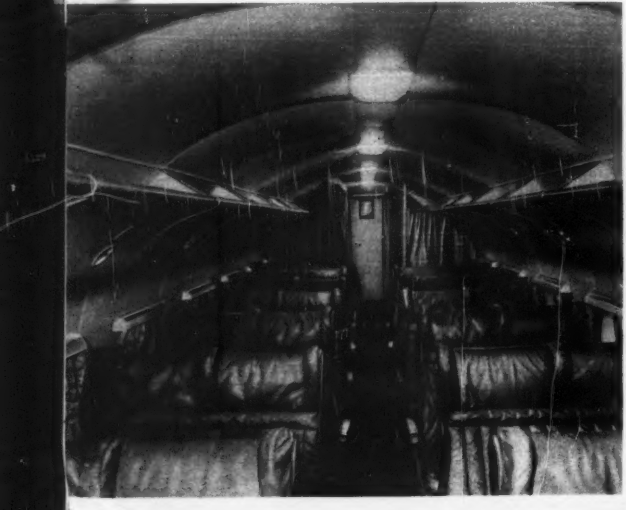
Among the detailed improvements for passenger comfort are individual reading-lights and ventilation louvres, while the entrance steps, when open, are illuminated by a spotlight positioned in the fuselage.

The finish, in B.E.A.'s new colour scheme, with its white-topped fuselage, full-length parallel red lining, and the Corporation's new large lettering, has given the Pionair a handsome external appearance. It also sports a new-style B.E.A. brevet, the position of which, it is understood, will now be re-aligned so that it is parallel to the aircraft centre-line and not to the ground.

There is little doubt that, when they come into service this summer, B.E.A.'s Pionairs will rank high in passenger-appeal; crews, also, will appreciate their much improved cockpits and internal arrangement. It is from the operator's viewpoint, however, that the conversion is of most interest, for the Corporation has estimated that so great will be the reduction in operating cost, and the increase in revenue-payload, that the cost of conversion is likely to be recovered in the first year of operation. As it is intended to use the Pionairs for five or six more years the potential benfits are obviously very great. When used in the United Kingdom over B.E.A.'s average stage-length of 170 miles, the Pionair's fixed operating cost per seat-mile will be 17 per cent less than that of the Dakota, while the variable costs will be down by 19.5 per cent. The actual figures are, respectively: Fixed, Dakota, 5.01d per seat-mile, and Pionair, 4.16d; variable, Dakota, 2.94d, and Pionair, 2.3d.

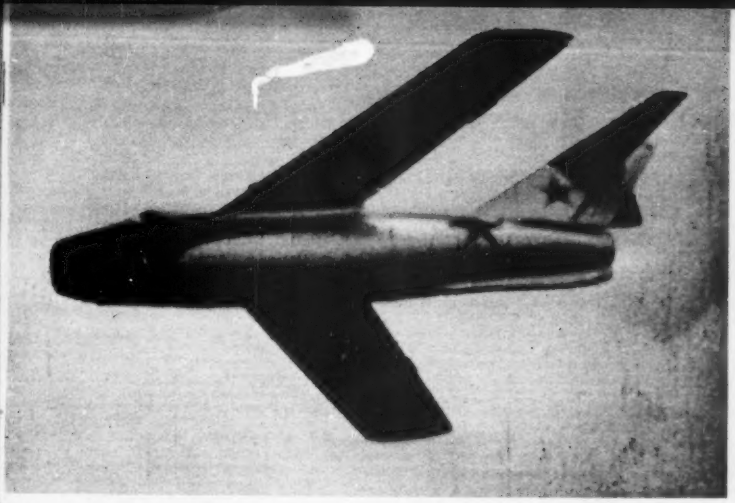
The forward end of the cabin, showing the addition of the extra row of seats which has been made possible by moving the old bulkhead forward by 3ft. (The starboard double-seat has been removed for this photo).

The use of pastel shades in interior decoration has given a light and spacious appearance to the cabin: the entrance to the toilet compartment can be seen at the far end.



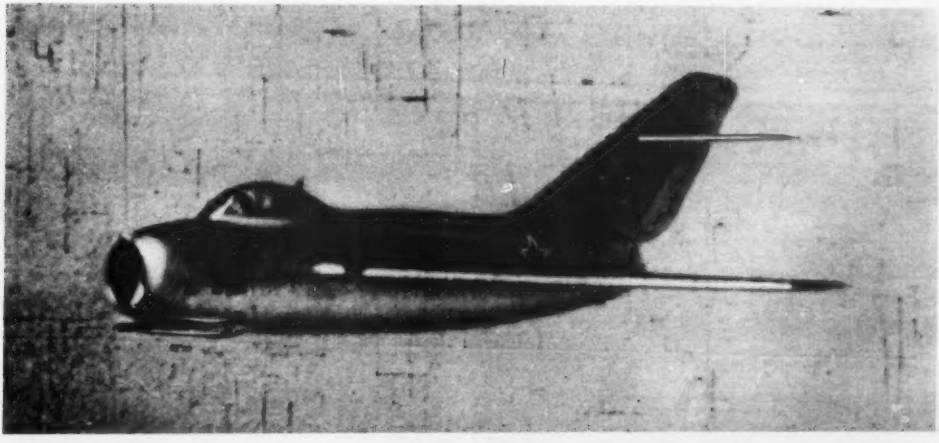
Much of the promise of this attractive conversion springs from the enthusiasm shown in the work by Scottish Aviation, Ltd., and from the fact that they are undertaking the job at a very reasonable cost. Although varying with the actual amount of work needed in each individual case, the price quoted will allow B.E.A. to stand in the Pionairs on their books at around £12,500, which—for an aircraft that is virtually new in construction and which as a new design would have cost anything from £40,000 to £80,000—obviously represents a commendable piece of business.

Few, if any, civil aircraft have given such long and sterling service as has this Douglas twin-engined series. It is fitting, therefore, that in the evening of this worthy machine's life, B.E.A. should have chosen to honour the type by naming its Pionair fleet after the great figures of British aviation. Thus the spirit of men like Sir John Alcock, Sir George Caley and Sir Sefton Brancker will travel with these aircraft as they enter yet another phase of a seemingly endless career.

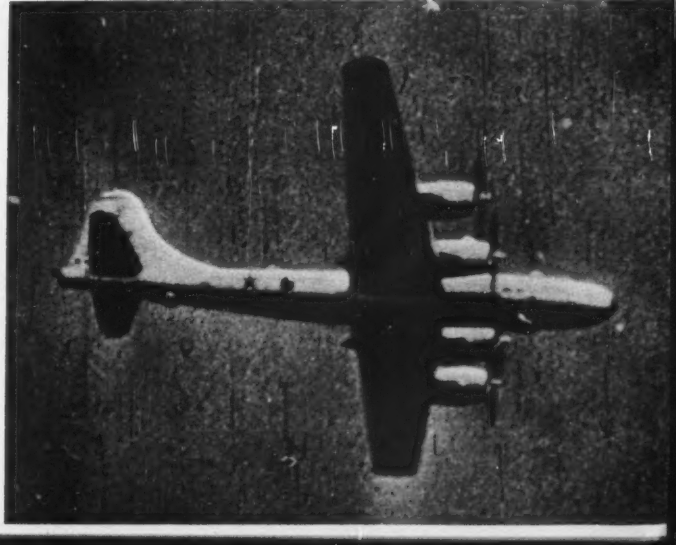


Particularly in respect of wing design, this "still" from a Russian newsreel, captured in Korea, is valuable in supplementing previous pictorial evidence concerning the new Lavochkin jet fighter. The pictures below are from the same source.

Intelligence from Celluloid



Note, in the above view of the Mig-15, the form of the intake and the exceptionally large area of the "vertical" tail surfaces. Projections from the lower part of the nose are probably cannon-barrels. A gun armament of one 20 mm and one 30 mm weapon is reported, but there is as yet no evidence to confirm the rumoured "automatic rocket-launcher" installation.



Reported from Washington to be designated Tu-4, this Soviet B-29-type bomber is seen to be identical—in all major respects at least—to the original Boeing design. In the U.S.A.F. the Boeing B-50, a greatly improved version with Wasp Major engines, is already in large-scale operation.

JOURNEY EAST

PART II

Narrative and Photographs
By JOHN YOXALL

Air Marshal Sir Francis Fogarty, A.O.C.-in-C. F.E.A.F.

Deployment of F.E.A.F. : Brigand versus Brigands : Impressions of Operational Sorties

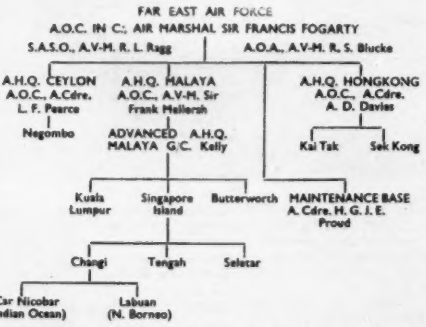
THE history of the Far East Air Force dates from January, 1930, when the R.A.F. units in Singapore Malaya and Hong Kong came under Air H.Q. Far East. This arrangement continued until Singapore was evacuated in 1942, when the command was re-named "British Air Forces in India." Twelve months later, "Air Command South East Asia" was instituted. The new formation included all units in India, Burma and Ceylon and after the Japanese war those in French Indo-China, the Netherlands East Indies, Malaya, Singapore, Siam and Hong Kong were added.

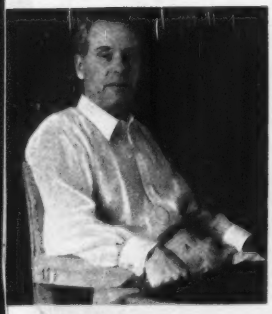
All R.A.F. units in Indo-China, the Netherlands East Indies and Siam were disbanded by 1947, and in 1949 the present designation of "Far East Air Force" was adopted. F.E.A.F. now embraces Ceylon, Singapore, Malaya, Hong Kong, Japan, Car Nicobar and Labuan.

A glance at the map will show that the command can be likened to a right-angle bracket containing all the troublesome areas of the Far East within its base and perpendicular. Adverse comment has been passed on the numbers of aircraft actually available at any one moment at Far East stations. What is generally overlooked is that these stations represent outposts—to be held until support from the strategic reserve can be made available.

In an emergency, jet-fighter squadrons from this country, with their ground crews taken out by Transport Command, could be operating in the Far East within a week. Another consideration, not to be lost sight of when assessing air strength to-day, is that within an hour a modern fighter-bomber—carrying a punch equal to the broadside of a six-inch cruiser—can be attacking a target 400 miles from base.

Whether our present strategic reserve is large enough, or whether it is properly balanced, is beside the point. The answers to those questions do not affect the elementary fact that it is bad strategy to disperse strength too widely. Other con-





Left : Mr. Malcolm MacDonald, Commissioner-General for Malaya. Right : Air Vice-Marshal Sir Frank Mellersh, A.O.C. Malaya.

S/L. Unwin, in background, checks his load of missiles before take-off. The remaining two 500-lb bombs are under the wing.

After the strike : A pretty piece of " echelon to starboard " on the way back to base.

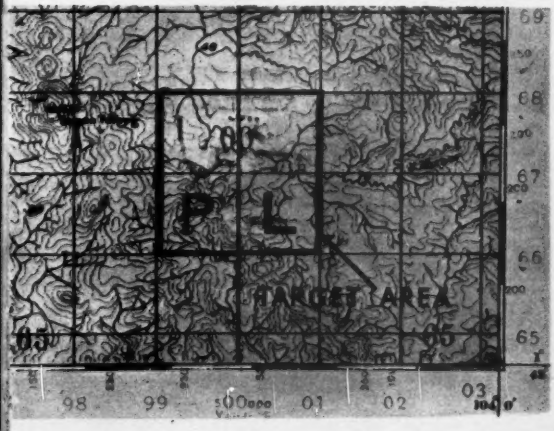
siderations include the facts that the Americans are in the Pacific in considerable numbers and that the key position in Indo-China is still held by the French —albeit only just.

On the debit side is the new Chinese air force now being built up under Russian supervision. It is expected to have a front-line strength of about 1,000 aircraft by the end of the year. What its fighting quality will be remains to be seen, and whether the Asiatic mind is capable of coping with the maintenance and flying of jet-propelled Mig 15s will also be answered in the future. One thing is certain—the Yellow Peril, almost a music-hall joke for the past 50 years, is now a grim reality; and it is being encouraged, armed and trained by a great European nation.

The set-up of Fast East Air Force is shown in the accompanying " tree." The A.O.C.-in-C., Sir Francis Fogarty, and the A.O.C. Malaya, Sir Frank Mellersh, were kind enough to review the salient points of their problems and the strategy employed to combat them.

The area affecting the situation in the Federated Malay States is so extensive that it might almost be called global. The morale and activities of the Malayan bandits fluctuate to a large degree with the war news from Korea and even with the political battles fought at Lake Success and elsewhere. The trouble in Malaya is entirely due to the strong Communist forces which have been developing over the past 30 years. During the war we armed and trained them to fight the invading Japs, and they obtained the impression that they would take over the government of the Federation when hostilities ceased. The bandits are well trained and organized into units; at the same time, many of them are squatters who earn a legitimate living by day as rubber tappers (i.e., by bleeding the rubber trees for latex) and are bandits only by night. Their headquarters are often deep in almost impenetrable jungle and an opposing force can easily pass within 50 yards and see no sign of them. Some idea of the density of this jungle, which covers three-quarters of the whole Malayan peninsula, is given by the fact that on one occasion it took ground troops 13 days to reach the wreckage of a supply Dakota which had crashed only seven miles away. To this difficulty must be added the facts that the jungle rises in some places to 7,000ft and that swampy areas are extensive. The Malay States, it must also be remembered, lie between degrees one and six north of the equator.

Map and photograph of the " strike " area. Take out grid and contour lines, remember that the rivers cannot be seen, than find the target.



Briefly, the anti-bandit methods employed are as follows:—

Ground troops, Gurkhas and Malays as well as British troops, patrol suspected areas and, if contact is made, a signal is sent asking for an air strike. For this purpose an area of jungle some 2,000 yards square is indicated as the target and Government troops position themselves, at a safe distance about its perimeter, to ambush any bandit attempting to escape from the attack. An " immediate " call by the Army can be planned, and the strike airborne, within 45 minutes.

Available are Spitfires with 4 × 20 mm guns and eight rockets; Tempests with the same armament; Brigands with 4 × 20 mm guns, 3 × 500lb bombs, 1 × 1,000lb bomb and six rockets; and Lincolns carrying 14 × 1,000lb bombs and employing any of their defensive armament for ground strafing. In addition, Sunderlands down at Singapore on " rest " from patrolling Korean waters sometimes pepper the suspected areas with 320 × 20 lb bombs. This last form of attack appears on the face of it to be the most desirable, but it is difficult to find the enormous amount of labour required to fuse the bombs. Another weapon used is a special bomb dropped from Dakotas which, two hours after being dropped, creates surprise, alarm and despondency by simulating rifle-fire.

To get a more intimate picture of the problems I flew on a strike, in a Brigand piloted by S/L. Unwin, D.F.M., code-named *Pongo*, the operation was with the 2/6th Gurkhas, who had located some bandits in thick jungle north of Kota Tinggi. The usual area had been indicated and our own troops deployed round the target. Maps were carefully checked with air photographs, the greatest care being taken to ensure absolute accuracy, for the 20-year-old maps are far from correct and frequently there are no landmarks to guide navigators. The usual method of locating a target is to fly a course by time and bearing from the nearest known landmark. The ground forces, where possible, help pinpointing by making coloured smoke or firing mortars. At night searchlights are used.

Brigand crew (left to right) : Sgt. M. Rees, signaller, F/L. W. Banks, navigator, and a crew's view of S/L. G. C. Unwin, D.F.M.

JOURNEY EAST . . .

To get over the target before the tropical cumulo-nimbus clouds formed we were in our Brigand at 0730 and even at this early hour the steamy, close interior of the aircraft was almost unbearable. The high moisture-content of the air caused big fluffs of condensation to pass across the wing chord as the air-screws flailed round for the take-off; two trails also streamed from the wing-tips. The jungle presented a sullen sight—a green desert covered with low clouds, over which a higher top layer cast a pervading gloom.

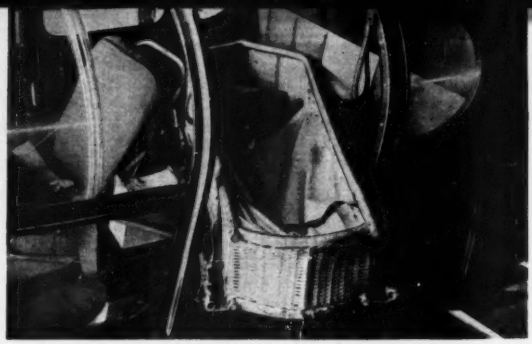
Passing above some rubber plantations, which appeared so smooth, in comparison with the jungle, as to be suitable for landing, we arrived over the target area at 0758 hr. The low cloud prevented sufficiently exact location of the target and we took our distance and bearing from the river bridge at Kota Tinggi, endeavouring to get below the grey vapour. At one time we were at 500ft in the lower edge of cloud-bank; and it was adhering to the jungle-covered hills.

This hide-and-seek in "stuffed clouds" continued until 0959, when the accompanying Lincoln dropped its load of 14 × 1,000 lb bombs. We ourselves followed, with a dive from 4,500 to 1,500ft, to release our stick in the order 500 lb, 1,000 lb, 500 lb, 500 lb. Another circuit and our rockets went in from 1,200ft; the cannon strafe was made in three dives, during which we came so low that details of individual trees could be observed. As the Brigand's cannons are fired the whole aircraft chatters and the cockpit momentarily fills with the reek of burnt cordite.

The other Brigands on the strike had all finished by 1030, and we returned in formation to Tengah airfield, whence we had departed over three hours previously for an operation which should have lasted one hour.

All this, one felt, seemed a very expensive and complicated manner in which to carry on war with bandits; but, as A.V-M. Sir Frank Mellersh observed, "If air support were withheld, initiative would pass entirely to the insurgents. And if the bandits are not killed they *are* kept on the move."

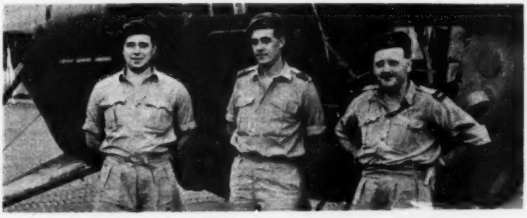
When one is assessing the cost of such a war it is as well not to set the price of so many bombs and so much effort against a few dead bandits. What must be remembered is that Malaya, with its vast resources of rubber and tin, is by far the largest dollar-earner in the whole of the sterling area and that these expensive efforts against the insurgents do enable the Federation to continue to function economically. This cost accounts for $ Malay 280 million out of total revenue of less than $ Malay 400 million. The only alternative to continual land-and-air operations against the guerrillas is to set up a number of fortified key-points and let the bandits roam free over the remainder of the country, setting up headquarters where and when they will; but the result of such a policy, after a very short while, would be no rubber and no tin, because the operators would be at the mercy of the bandits. Incidentally, many of the latest guerrilla camps to be found include dug-outs as protection against bombing—a fact which speaks for the effectiveness of the air weapon.



The locally made wicker basket for carrying wounded in the Westland Sikorsky S.51s. It replaces the external pannier.

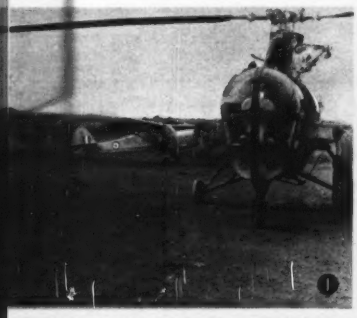
The total number of bandits is estimated at about 5,000, and the figure remains constant. In view of this fact the following figures are of interest (they cover the period from the start of the operations to about the end of November):—

	Killed	Wounded	Missing	Captured	Surrendered
R.A.F.	30	11	—	—	—
British Troops	214	332	2	—	—
Police	529	551	7	—	—
Civilians	1,242	775	346	—	—
Insurgents	1,515	549	—	750	444



Three helicopter pilots: F/L. A. J. Lee, F/L. K. Fry, who commands the Helicopter Evacuation Flight, and F/L. J. R. Dowling.

A helicopter evacuation, photographed by F/L. Dowling. Left to right: (1) The S.51 on the Auster strip at Segamat. (2) Clearing as seen from the Auster. (3) S.51 on floor of clearing—engine is not stopped; patrol-leader holds cyclic-pitch control. (4) Take-off from clearing with casualty on board. (5) Over the tree-tops and away for Segamat. (6) Transferring the patient to a stretcher for despatch to hospital.



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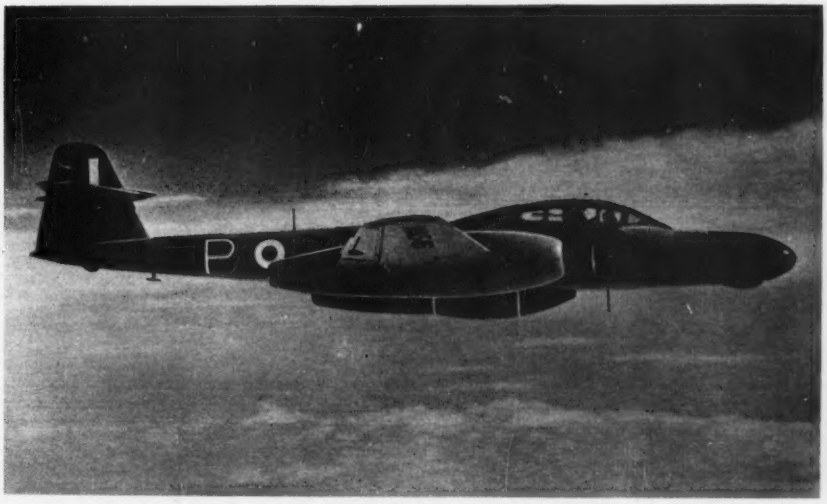

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Through the notorious Kanching Pass : The rock formation is known as the Tiger's Tooth.

(Left) A signaller of the R.A.F. Malay Regiment.

(Right) S/L. E. Johnson gives instructions to Gunner Agus ben Bahari of the R.A.F. Malay Regiment.

JOURNEY EAST . . .

Despite this big concentration of effort in forwarding General Sir Harold Briggs's plan for clearing the militant Communist element out of the Federated Malay States it must be remembered that the Royal Air Force is in the Peninsula primarily for its defence against possible aggression from outside. This is the reason for re-equipping No. 60 Squadron with Vampires. The bandits have no aircraft.

Another aspect of the jungle warfare is the removal of casualties by helicopter when difficulties of terrain demand it. The helicopter flight, under F/L. Fry, has three Westland Sikorsky S.51s, one of which must always be at two hours' readiness. In actual fact it can usually get away in 30 minutes. With two pilots on board it still carries sufficient fuel for three hours at 60 knots plus a safety margin of 30 minutes. The standard external stretcher panniers have been discarded and locally made wickerwork baskets substituted: they are much lighter and can be stowed almost entirely inside the cabin. On an operation the spare pilot reclines in the basket.

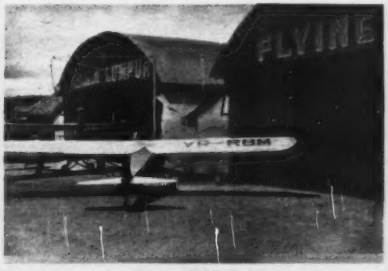
On receipt of a request to remove a casualty, an S.51 is flown up to the nearest A.O.P. Auster strip, of which the Army has a number. From here the helicopter pilot is flown in an Auster over the spot from which the evacuation is to be made, to check whether conditions are "posaible." Not much is asked for. The jungle trees frequently reach nearly 200ft and evacuations have been made where the lateral clearance low down has been as little as 4½ft outside the rotor circumference. The loaded weight of the helicopter, with approximately 40 gallons of fuel and a casualty weighing about 180 lb, allows for a direct vertical climb of about 130ft. At this height trim is altered to give a forward speed of 25 m.p.h. and the final few feet are climbed at a rate of 340ft/min. I was treated to a dummy run at this and found it was most impressive. It was only too easy to believe that on at least four evacuations of casualties from tiny jungle clearings the helicopters' rotor-blades had fouled the trees.

While I was in Singapore there came a request to rescue a woman bandit who had been deserted and found starving in uncharted jungle, ten miles from the Siamese border and 450 miles from the helicopter base at Changi. A start was made at 0600 hr and by a series of hops the area was reached by 1400. Heaped-up cu-nim cloud, however, prevented rescue until the following day, when the lady was safely extracted from the jungle; and the helicopter's pilot has almost certainly earned the nickname Tarzan.

G/C. M. H. Kelly, escorted by an armoured car, leaves Rawang for Kuala Lumpur. The R.A.F. Regiment officers' mess is in the background.

Supply-dropping crew : In door, Drivers Simpson, Greenwood and Stone ; centre, L/Cpl. Lewis ; bottom, F/L. Powell (Nav.), F/L. Figg (Pilot) and Sgt. Noble (Sig). (Bottom, right) The scene at the parachute door as a consignment leaves the Dakota.

G/C. M. H. Kelly with W/C. G. T. Wynne-Powell. D.F.C., Station C.O., Kuala Lumpur.



The flying-club hangar at Kuala Lumpur. This is one of the oldest flying clubs ; it was started many years before the war.

A pleasant sight for English eyes : December flowers on the lawn at Kuala Lumpur.

Native women labourers at work on the Kuala Lumpur runways—the only male is the foreman.

At Butterworth : (left) : The control tower ; (centre) N.A.A.F.I. break—in the background is a P.R. Mosquito ; (right) The Officers' Mess.

JOURNEY EAST . . .

In the recent Singapore riots, too, the helicopter flight proved extremely useful. Operating from a football ground in the city, the pilots were able to pass on to the police and troops information regarding any concentration of rioters.

To digress for a moment to the A.O.P. airstrips, the Army is doing a fine job of work from these Lilliputian landing-grounds. They are in most cases made of laterite, a local macadam of the colour of Devon earth and the majority measure about 300yd × 25yd. The Austers are serviced by the R.A.F. but the pilots are all Army personnel.

If some of the results obtained by air strikes are in any way questionable in value there is no doubt whatsoever of the effectiveness of air supply to the ground forces. The jungle headquarters are often far from any means of surface transport and in this connection it should be remembered that Malaya is almost devoid of east-west roads. Without air supply ground warfare would be impossible.

The base for supply-dropping is Kuala Lumpur, where Advanced Air H.Q. is commanded by the A.O.C.'s personal representative, G/C. M. H. Kelly. Kuala Lumpur (or "K.L." as it is always abbreviated out there) is the centre of all the anti-bandit activity. The combined-operations room is there, and normally the fighter and transport squadrons share the airfield. Owing to urgent repairs to the runway the Spitfires and Tempests have moved out and only a skeleton force of Dakotas is left in residence for supply-dropping.

The business of air supply has a technique all its own and I was privileged to see it in action by going on a Dak which was scheduled to drop 450 lb of supplies on D.Z. *Fox*, north-east of Ipoh (for some Commandos), 1,700 lb for social welfare on D.Z. *Oboe* and a further 1,600 lb, for the 3rd Malay Regiment, on the same dropping-zone. Our final call was to be *Oboe Bar*, where another 640 lb was to go overboard, also for the 3rd Malay Regiment. The last two bases are made in the jungle, about 100 miles north of K.L. airfield, in the Kordu Reserve Forest. There are no other means of supply.

Like every other air operation in this area, supply-dropping has to be done in that short period between the clearing of low cloud and mist in the morning and the forming of cu-nim under the influence of the tropical sun. Briefing was at 0730 hr, with take-off 45 minutes later; even so, cu-nim could be seen forming over the distant hills. Safety precautions appear to be cheerfully non-existent—there are no seat-belts, for the good reason that there are no seats; the door is off; and a slippery floor adds to one's general feeling of insecurity.

The temperature rose quickly in the pilot's cabin, and he dashed off the sweat which poured down to his chin. We climbed to 6,000ft, but the Cameroons, alongside which we travelled, were still a thousand feet higher. Big tin-mining areas crept slowly back below. As we passed Ipoh, the five-minute signal was given to the despatchers. This warning enables them to get the appropriate packages and parachutes to the cabin door, just balanced and ready to be pushed outward. Each despatcher has a webbing belt and anchor strap to make sure that he does not, in the excitement of the moment, follow the packages. In actual fact, with the aircraft now down below 1,000ft, the scene at the cabin door was full of drama. The despatchers held the packages against the tearing wind and bumps which threatened to pull them out before their proper time. The signaller stood by, with headset on, ready to give instructions. With muscles strained they waited for the three rings ("Prepare to drop"), then for the final single ring, and overboard went the loads. A quick look out was taken to see that all parachutes had fallen clear and that the D.Z. had been hit fair and square. Satisfied on that point, the despatchers sat back on the remaining cargo as the pilot pulled the Dak out in a climbing turn to head for the next D.Z.

The tension relaxed, one of the despatchers pulled out a pocket comb to straighten his wind-ruffled hair and all was calm once more—except at the rear of the cabin, where the draught from the open door caught the row of hanging Mae Wests, making them look for all the world like yellow octopi waving their tentacles.

The first load for the next D.Z. was rice for troops of the 3rd Malay regiment; it was encased in double sacks for free dropping without parachute. This zone, however, was covered in cloud and although we tried very hard to find a way through it was impossible so to do. From there we moved on to an alternative site where, by virtue of very careful flying, we were just able to get below cloud. It is very impressive to be in one of these Daks, flying at all sorts of crazy angles to avoid the trees and hills until the short level flight of the run-in. *Oboe Bar* was also located and supplied, and from there we climbed through the clouds to 7,000ft and set course for home at 1030 hr at 120 knots.

Some miles from Kuala Lumpur, through the notorious Kanching Pass, is the headquarters of the R.A.F. Regiment at Rawang. The road between K.L. and Rawang has been the scene of a number of ambushes and as a safety measure the jungle has now been cut back for some 100 yards on each side of the road. For the visit I travelled with G/C. Kelly, and our car was escorted by an armoured vehicle. A padre accompanying the party pointed out all the places where incidents had occurred.

No. 91 Squadron R.A.F. Regiment, who had been in Malaya some eight weeks, were then at Rawang, and will remain there until relieved by another squadron. There are five of these Malay squadrons, in which all the officers and some of the n.c.o.s are British, the remainder being Malays. Strength of each unit is about 170 all ranks. Their duties include guarding of the airfields at Changi, Seletar, Tengah and Kai Tak, and Kuala Lumpur. Each duty is assumed for a period of five months.

For operations they come under the Scots Guards. Each patrol from Rawang goes out some twenty-strong and remains in the jungle for six days. The party is armed with Bren and Sten guns and each man carries a rifle; sometimes a 2in mortar is also taken. Yellow flashes worn in their caps ensure that the men are not mistaken for bandits. On return from patrol they seem, understandably, somewhat exhausted, and the sickness incidence rate goes up a little; but every endeavour is made to give every man a night in bed for each one he has spent in the jungle.

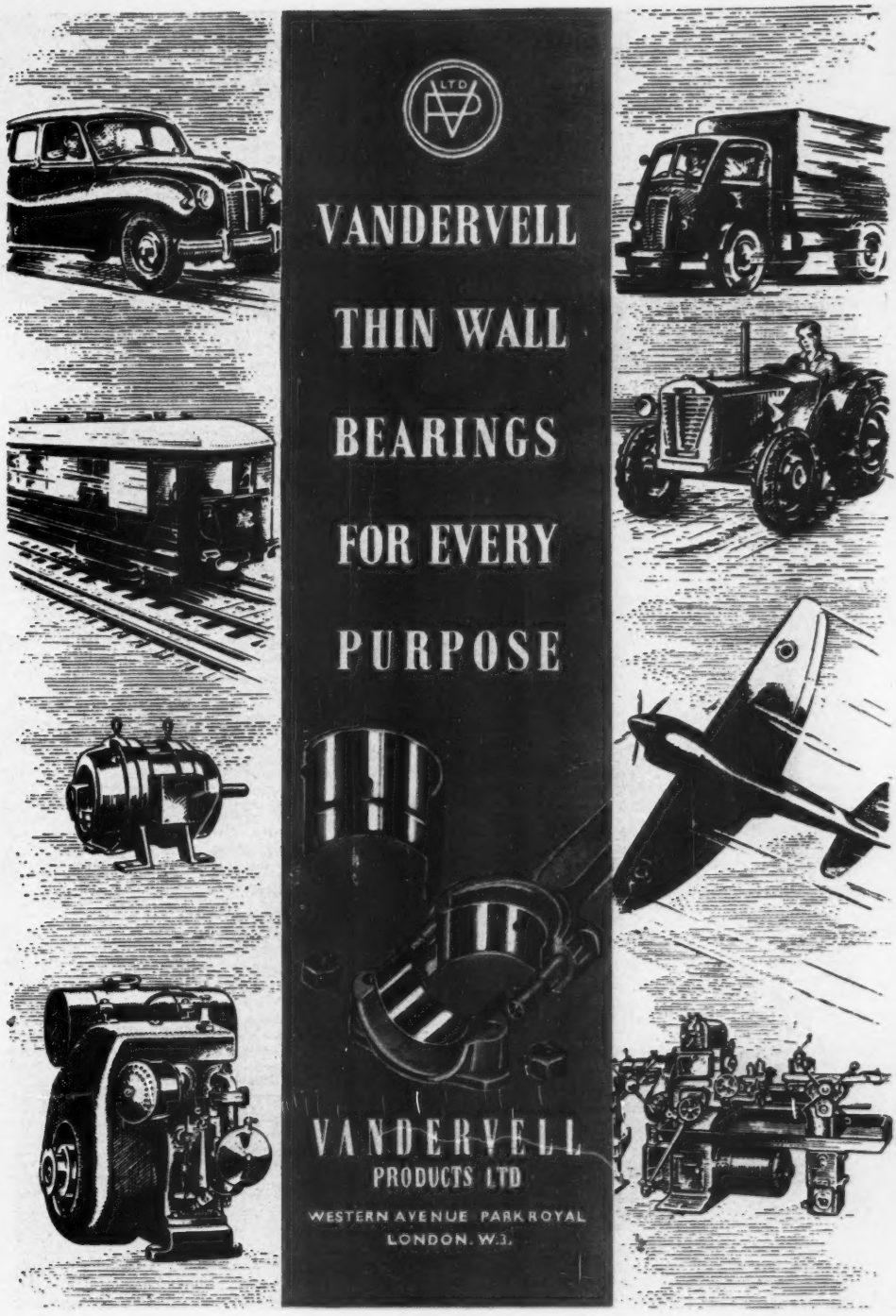
The most northerly R.A.F. station in Malaya is Butterworth, situated on the mainland opposite the island of Penang. Normally it is non-operational but, with K.L. more or less out of use until the runway is repaired, the Tempests are there, plus a detachment of P.R. Mosquitoes from Seletar on Singapore island. Butterworth is also a temporary stopping-place for Malayan Airways, because Penang airport is also unserviceable. It ordinarily functions as an armament practice-camp, where fighter and fighter-bomber squadrons are sent on detachment. Three little islands, some 25 miles away, serve as a target area.

On the island of Penang is a leave camp for the whole of the R.A.F. in Malaya. The air is a good deal drier than it is in Singapore, and the atmosphere much less enervating.

Many airports in many lands have been publicized as "Clapham Junctions" of the air. Of Singapore, in relation to the Far East, this can be truly said. Fortunately, also, the Government of the Island is very air-minded and intends to keep abreast of modern airport developments.

The present civil airport at Kallang, when it was opened in 1937, was considered to be one of the finest in the world. It then had a maximum runway length of 1,000 yards, which the Japs doubled during their occupation. No further extension is

Mr. A. W. Savage, Director of Civil Aviation in Malaya, with the plans of the new Paya Lebar airport before him.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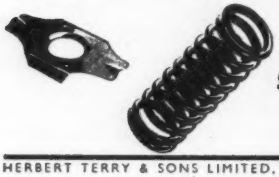

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JOURNEY EAST . . .

possible, because the entire surroundings are completely built over.

It has been decided to build a new airport six and a half miles away at Paya Lebar, and it is expected that the price obtained for the Kallang site as building land will more than pay the cost of the new airport. The ground at Kallang, when it was originally bought, was swamp land worth very little.

The layout of Paya Lebar will be that of a staggered H, each vertical represented by a runway of 10,000ft. This, it is felt, will cater for American requirements and comfortably take the Comet, for which 7,600ft has been requested. In addition to the 10,000ft of each runway, provision will be made for a further 1,000 yards with nothing higher than a palm tree. The plans allow for four bays for gas-turbine aircraft, and these bays will have blast walls to prevent damage and inconvenience from jet efflux. It was expected that it will take at least two years to build the runways of this new airport.

There are no nationalized airlines in the Federation. Malayan Airways, the designated air carriers for Singapore, the Federated States, North Borneo and Sarawak, are subsidized only to the extent of free use of landing field, no landing fees and free hangarage at Singapore. The company flies six Dakotas, which are almost always filled to capacity.

The jungle, so far as transport is concerned, gives the same traffic advantage to aircraft as does water. There are no east-west roads in Malaya and the other roads and railways are bandit-ridden. More aircraft are wanted, and there is a suggestion that, when B.E.A. wish to dispose of their Vikings, Malayan Airways will be pleased to consider buying them.

A need is also felt for local services in the jungle areas, using quite small aircraft—certainly no larger than the D.H. Beaver, though some people would advocate two engines for work over this terrain. Planters would be encouraged to cut airstrips for them. By this means, valuable feeder services could be run to the airports at Penang, Butterworth, Kuala Lumpur and on Singapore Island. One Malayan dollar (2s 4d) per mile is cited as a probable operating cost for these small aircraft.

(*To be continued*)

HANDLING ROCKET MOTORS

The Highly Specialized Art of Servicing and Flying the Bell X-1

ALTHOUGH there is nothing new about rocket-powered aircraft none has yet been built in this country, nor have any been flown here; details of handling-methods employed for the rocket motor of the American Bell X-1 research aircraft published recently in *Aviation Week* are therefore of unusual interest. The information is digested from a lecture by Richard F. Gompertz of the U.S.A.F. Power Plant Branch at Edwards Field, delivered at the American Rocket Society's fifth annual convention. This, incidentally, was held in conjunction with the American Society of Mechanical Engineers.

It is four years since the X-1 first flew, and the fact that there has not been a single serious accident with its potentially explosive fuel system is noteworthy. The Bell's rocket motor (details of which were given in *Flight* of March 20th, 1947) was produced by Reaction Motors, Inc., and it first propelled the X-1—previously tested in gliding flight—on December 9th, 1946.

Pre-flight checks of the X-1's rocket engine, it appears, vary somewhat according to the results of the previous flight, but in all cases a complete pressure check is made by filling the propellant tanks with nitrogen and operating all valves and pressure switches from the cockpit. It takes a good deal of experience to conduct this phase, because observation of the engine components in the aircraft is difficult, due to the small number and size of access doors. Any leak is traced to its origin.

Igniter firing tests come next in the pre-flight check. Special test devices have been developed to inject a small quantity of the propellants into the engine for this purpose. Electrical systems are checked and actual ignition is observed visually and aurally from fifty feet or so away, the shape, colour and sound of the flame being checked.

Visual inspection of lines and components continues during other checks and propellant-servicing.

On the subject of fuelling, and the order in which the loading takes place, the author states the nitrogen is first pumped in because Reaction Motors' engine uses this gas to pressurize the propellant tanks and to operate all pressure-controlled valves. In addition, the nitrogen provides a constant bleed through the propellant valves and combustion chambers to avoid or neutralize any internal leaks which may develop.

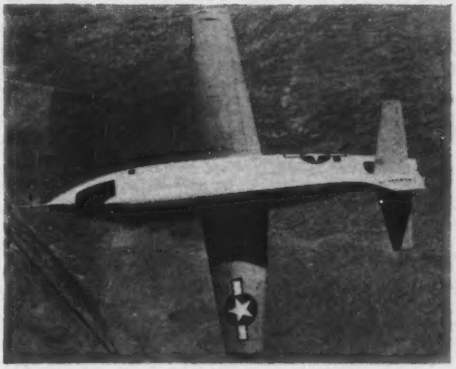
The nitrogen is stored at the flight-test base in liquid form, and for loading is passed through a converter and transformed into high-pressure gas. The gas is then expanded into the high-pressure storage system of the aircraft.

When pressure is available in the nitrogen system, the water/alcohol fuel is pumped into the tanks, using conventional methods. Having pressure up expediter this tanking process, because various valves and safety features operate only when pressurized. Liquid-oxygen tanking comes last, and is completed just before take-off time to minimize evaporation losses.

Throughout propellant servicing, the nitrogen supply line is left connected to the source to replace continuously the nitrogen which is lost through the bleed system.

Lastly, the ground crew checks the filler caps and the operation of the liquid-oxygen-tank vent valve; the mother aircraft and attached X-1 are then ready for take-off.

In the air an auxiliary source of nitrogen in the mother ship is connected to the X-1 storage system and continually "tops-up" the ground-loaded nitrogen tanks. Just before reaching drop altitude, the service crew aboard the mother craft—a specially modified Boeing Superfortress—disconnects this line.



As he drops from the mother ship, the pilot of the X-1 must regulate propellant-tank pressures.

At drop altitude, the pilot pressurizes the propellants, fuel tank first, then oxidizer. The propellant system is bled of all trapped gases and vapours so that liquid—rather than gaseous—oxygen will flow into the combustion chamber. This operation is completed 30 to 60 seconds prior to the drop.

Once the rocket aircraft is on its own, the engine generally requires some pressure regulation to increase tank pressure while the propellants are being expelled. The pilot monitors the tank pressure-gauges, holding the fuel tank at from 10 to 15 lb/sq in above the pressure in the oxygen tank. This results in a slightly fuel-rich mixture at the engine, but such a ratio increases combustion-chamber life and avoids hard starts and hard shut-downs for only a slight decrease in specific impulse (reciprocal of specific fuel consumption).

If the shut-down of the engine is intentional or activated by the emergency shut-down system, an air restart can be accomplished by the pilot. Only one cylinder is started or shut down at a time, to keep hydraulic surge and hammer to a minimum. Generally, the engine is shut down before propellant exhaustion. After cut-off, the pilot jettisons the remainder of the propellants, one at a time to decrease the chance of external ignition. Both tanks are then vented, but no purging is attempted at this time, because the purging agent—nitrogen—is expelled through the vent valves.

At the end of powered flight, the X-1 glides to its landing and waits for a specially equipped jeep to tow it in. Back in the servicing area, the last phase of the purging operation—that of tanks and pipelines—is completed, and the engine is thoroughly dried and cleaned internally. All the water/alcohol mixture is removed from the system to prevent corrosive action, all visible parts are inspected and the cylinders are checked for bulges or burn-outs.

THE HELICOPTER

PART III. *Present and Future Uses of Rotating-wing Aircraft : Trends in Design*

By Capt. R. N. LIPTROT, C.B.E., B.A.

THE value of the helicopter rests almost wholly on its characteristic ability to take off vertically and to fly under full control at low forward speeds even down to hovering. To be a commercial success as a transport vehicle, of course, and to be able to take its place in civil aviation as a machine complementary to fixed-wing aircraft, it must have a suitably high cruising speed. Because of its characteristics at and near zero forward speed it can fulfil duties which are not possible with conventional aircraft, and a major corollary of vertical take-off is the elimination of the need for airports with their specially constructed and expensive runways. Even though the helicopter is as yet in a relatively early stage of development, and the biggest type in production and available to operators is only a three/four-seater, it is already fulfilling a wide variety of roles. Some of these are discussed below.

The first concerns main airports catering for the large inter-continental fixed-wing aircraft. In spite of grandiose schemes for elevated airports over cities, such airports will in all probability always have to be situated outside urban districts. The helicopter, however, only requires a relatively small area, comparable with its own dimensions, for take-off and alighting, and so it can penetrate into the heart of built-up areas, thus cutting out the terminal losses due to tedious journeys between the airports and the towns which they serve. Taking average terminal losses, one can show that, even when cruising at only 100 m.p.h., as compared with a fixed-wing aircraft cruising at 300 m.p.h., the helicopter can show a shorter block-to-block time over stages up to something like 250 to 300 miles. Great Britain is too small a country to take full advantage of the modern high-speed aircraft for internal services, and yet there are several areas where surface transport is slow and an alternative is badly needed. This is particularly true of the Midlands in regard to transport between eastern and western areas.

The Minister of Civil Aviation recently indicated official policy toward the helicopter when he said that, while fixed-wing aircraft would doubtless continue to offer competitive service over some of the longer routes, such as London-Glasgow and London-Belfast, we needed a form of transport which could operate economically over short distances, and for this the helicopter was ideal. He indicated that it can confidently be expected that the helicopter will fill the gap in our transport system, since we have so many centres of population within short distances of one another.

Such an extension must, of course, await the availability of suitable helicopters, but a beginning has already been made on the Cardiff-Liverpool service run by British European Airways, and being used to develop operating techniques. The experience already gained from this and other experimental helicopter operations indicates that when we take account of the savings in capital cost and maintenance of landing areas of the necessary traffic-control system, and such services as navigational aids, the overall economics of the helicopter are such as to promise a satisfactory commercial future for it. Quite apart from airline operations there should be a lucrative business for charter operators in taxi services from the main airports to nearby town centres.

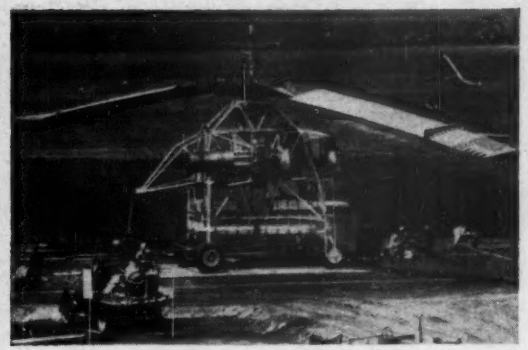
The helicopter's second role concerns mail shuttle services from General Post Offices to main airports, and also mail pick-up and delivery to remote communities and in areas where surface transport is slow. The B.E.A. Helicopter Experimental Unit has already operated such a service in East Anglia, flying a route between Norwich and Peterborough with thirteen stops at towns averaging about 20 miles apart. This service was first operated by day but, after some preliminary development of blind-flying technique and lighting aids, a night schedule was flown between Peterborough and Downham Market; finally, in late 1949

An impression of the Sikorsky S.55, shortly to be built by Westlands. A twin-engined version, primarily civil, may follow.

Stability demonstration with a Hiller 360. Like the Sikorsky S.51 and Bell 47, the type is in steady production in America.

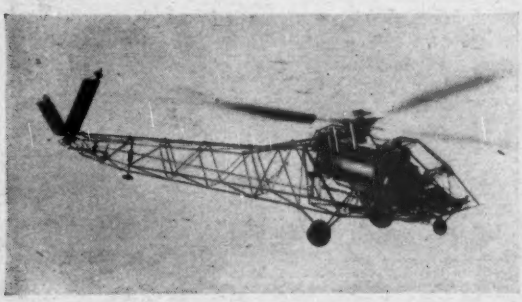
Kellett XR-10, an American design with side-by-side intermeshing rotors. It has an all-up weight of about 11,000 lb.

THIS is the third and last of a special series of articles by the former Deputy Director of Helicopter Research and Development, Ministry of Supply. In the first two he reviewed the history of the helicopter and discussed various aspects of detail design; in the present contribution he explains the value of this type of aircraft in the light of its unique characteristics, and indicates the most likely line of future development; he also reviews some outstanding current designs, particularly those emanating from France.



Largest ever : The Howard Hughes XH-17 has a jet-driven rotor 130ft in diameter. Two 3,000 h.p. gas turbines provide compressed air for the combustion units at the rotor tips.

A French intermeshing-rotor design : the S.N.C.A.C. N.C.2001.



Experimental single-seat S.E.3101, built as a scale model of a projected ten-seater and also developed as a two-seater.

and early 1950, a night mail service was flown to schedule between Norwich and Peterborough.

A similar mail service is in operation in the Los Angeles area of California, and has been very successful.

Thirdly, even though it has been available for only a few years in practical form, the helicopter has a noteworthy series of rescues to its credit. It has been used to take crews from sinking ships, to pick up fishermen marooned on ice-floes, to evacuate casualties in Burmese and Malayan jungles, and to rescue injured crew and passengers from an airliner which crashed in impenetrable forested area in Newfoundland; while in this country the revictualling of the storm-bound Wolf Rock Lighthouse will be remembered. The American Air Force authorities, fully alive to the value of the helicopter for rescue purposes, last year held a competition for a type intended mainly for Arctic rescue operations.

Fourthly, there are a host of other practical tasks for the helicopter, such as aerial survey; prospecting; forest, pipeline, power-line and coastguard patrol; crop-dusting and pest-control generally; and medical and veterinary work in sparsely populated districts. Every one of these operations has already been carried out with complete success by rotating-wing aircraft, and in all cases more efficiently than by any other known method.

Enough has been said to show that the helicopter, even in its present relatively undeveloped form, is already proving its value in many directions. All these more or less experimental operations have helped in developing techniques, and have brought to light the shortcomings of the available equipment.

The ideal at which the airline operator must aim is maintenance of schedules, even under completely blind conditions from take-off to landing. Already the existing helicopter can be flown blind for limited periods by competent pilots using standard instruments. It is, however, a fatiguing process, and before full-scale commercial operation in all weathers is practicable it will be necessary to improve stability and handling characteristics.

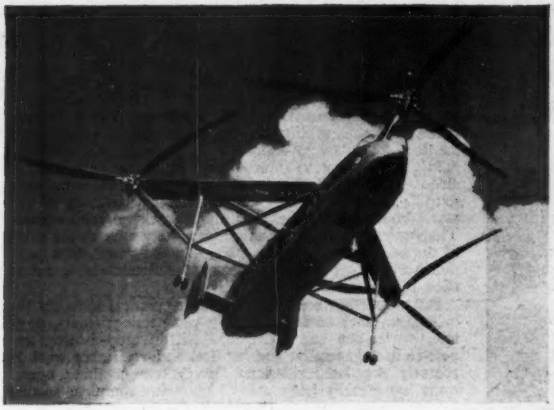
Navigational and ground-lighting aids have already been developed to a stage which is satisfactory so long as clear conditions prevail up to some 500ft from the ground; but to make any further appreciable improvement in safety and reliability of operation a blind-approach aid is necessary. Work in this direction has been proceeding for some time.

As regards the future helicopter itself, the following are the directions in which improvements must be sought:—

(1) Mention has already been made of the pilot-fatigue associated with blind flying. Operation into city centres will generally involve the use of small sites closely surrounded by buildings, and the minimum size for such a site will clearly be dependent on the steepness with which approaches can be made. Steep approaches are associated with very low forward speed, so that it is essential that future helicopters should have good control and stability characteristics under these conditions.

(2) The scope of all existing helicopter operations is limited by the fact that the types in use are all single-engined. Since aircraft transport can most advantageously compete with surface transport where water crossings are involved, and since the greatest advantage which the helicopter offers in civil transport is its ability to operate from the centres of cities, the multi-engined helicopter is essential before wide-scale scheduled operations can become feasible.

(3) Existing helicopters are expensive to operate and, indeed, their commercial use to-day is possible only where some form of subsidy is given, or, alternatively, where the service rendered is such that no other vehicle can perform it and high rates can accordingly be charged. The overriding consideration in the next generation of helicopters is, therefore, low operating cost. To achieve this aim the initial price must also be brought down. The present high selling price is, of course, largely due to the fact that heavy development costs are spread over relatively few aircraft. This will automatically correct itself when the right type of helicopter is available and the number which can be sold increases. Cruising speeds must be raised, since high operating speed is advantageous in reducing journey times,



Largest of the three M.O.S.-sponsored designs: the Cierva Air Horse, of 17,000 lb gross weight.

THE HELICOPTER . . .

in improving regularity in adverse winds, and in increasing the annual potential earning capacity of the aircraft. High annual utilization is a major factor in reducing operating cost, and this depends on the time the aircraft is serviceable. It is essential, therefore, that all parts should have long working life and be easy to maintain. Simple and cheap maintenance can make a most significant contribution to operational economy. The influence of size should also be mentioned. Increase in size, other things being equal, always reduces the total operating cost per seat-mile. For this reason, and because of the potential traffic which the new services will attract, we may expect that bigger helicopters, seating anything up to 35-40 passengers, will be demanded for airline use within the next few years.

Trends in development.—America may be said to be the birthplace of the commercially practical helicopter and, indeed, the only types available to-day for the would-be operator are the Sikorsky S.51 (which is built under licence in this country by Westland Aircraft, Ltd.), the Bell 47, and the Hiller 360; and it is on these types that the major amount of experience in helicopter operation has been obtained. All three are relatively small aircraft of single-rotor-with-tail-rotor configuration. Other than the three names mentioned the only makers in production are Piasecki, who are wholly engaged on Service orders; except for their first experimental machine they have devoted themselves to developing the tandem-twin-rotor type illustrated in Part I of this article. The first Piasecki accepted by the U.S. Navy was a machine weighing 6,900 lb (of which the disposable load was about 2,000 lb), with a single engine of 600 h.p. It was followed by a very similar but more refined type, the HRP-1, and then by the latest, the HRP-2. This last is a bigger machine, though still with the same 600 h.p. engine; it weighs 11,500 lb, of which 4,500 lb is disposable load, equivalent in civil use to a payload of 11 passengers plus 330 lb of luggage with a cruising range of 150 miles. The Piasecki concern is also engaged on the design of a large tandem-twin-rotor helicopter for freight-carrying or rescue duty. The estimated gross weight is of the order of 27,000 lb, the empty weight being some 18,000 lb. This is the first Piasecki design to be twin-engined, each of the power units developing 1,425 h.p.

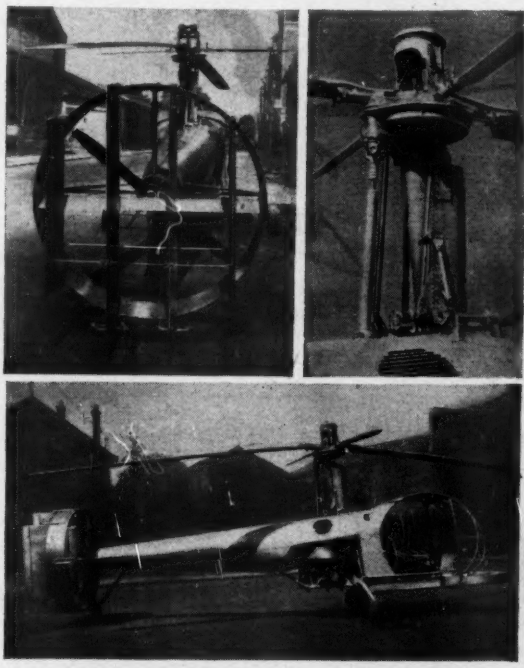
Sikorsky's latest type, still maintaining the single-rotor-with-tail-rotor configuration, has a single 600 h.p. engine and weighs 6,800 lb. It carries a crew of two, eight passengers and 300 lb of freight over a range of 200 miles, cruising at 86 m.p.h. This machine, the S.55, is to be built in this country by the Westland concern, who will, however, develop it into a twin-engined machine; the power units will be of the Leonides type, as in the Westland version of the S.51.

The Bell Company followed its well-known two-seater with a five-seater weighing roughly 5,700 lb, with a 600 h.p. engine, and their latest type is a 12-seater weighing 7,500 lb with an engine giving 800 h.p.

Broadly speaking, American development has taken the form of increased flying weight, and therefore payload, without any great increase in power, thus tending to lower, if anything, the hovering performance while keeping the operating speed in the region of 85 m.p.h. So far the need for more than one engine does not appear to be regarded as essential.

This, of course, is by no means the whole picture of American development, since there are a number of firms developing a variety of novel types. The most interesting of these, perhaps, is the Kellett XR-10, a large, twin-engined type of the twin side-by-side inter-meshing rotor type. It weighs some 11,000 lb, with disposable load of about 2,800 lb, the engines each developing 550 h.p.

Then again, there are a number of experiments in progress to develop jet propulsion for helicopter blades, involving use of the three varieties of jet-reaction device, the ram-jet, the pulse-jet and the so-called central-pressure scheme, in which a compressor provides air which is ducted through the blades to combustion chambers at the tips, where additional fuel is burned. The aircraft are mostly small, but there is one—using the central-pressure scheme—which, when completed, will be the world's largest helicopter. Commenced by Kellet, but later taken over by the Howard Hughes concern, it has a rotor no less than 130ft



Nord N.C. 1700. The detail views show the auxiliary blades which regulate the pitch of the main blades in order to reduce flapping, and the cowled control-surface system at the tail.

The Fairey Gyrodyne—a private venture—took several speed records.

in diameter, and the compressed air for the jets is provided by two 3,000 h.p. gas turbines. The complete rotor, with power unit, has already been completed as a test rig, and is expected to lift over 40,000 lb, i.e., twice its empty weight, when fitted to the aircraft.

One most important trend in America is the move towards metal rotor-blades to take the place of the fabric- or plywood-covered blade. It is not difficult to appreciate the advantage of metal blades when it is pointed out that N.A.C.A. full-scale tests have shown that the profile drag may be 20 to 30 per cent less than that of a plywood blade, and anything up to 70 per cent less than that of a fabric-covered blade. This, of course, is due to the fact that the metal blade maintains the aerofoil contour better than do the other constructions, and also permits a better and smoother surface finish. This reduction in profile drag not only reduces the power expended in overcoming the drag of the blades, but also improves the autorotative properties. N.A.C.A. tests have shown that a 20 per cent reduction in blade-profile drag results in a 6 per cent reduction in the minimum rate of descent in an autorotational glide. Moreover, metal blades, particularly those using stainless steel, possess good resistance to fatigue, abrasion and corrosion. They also lend themselves to mass production techniques resulting in lower cost, and simplify the problem of blade de-icing.

France has always been in the forefront of helicopter development and immediately after World War II, during which her helicopter designers had been quietly continuing their work, she was able to start off with quite an impressive programme. Unfortunately, this programme has been severely curtailed, mainly by financial difficulties. Several types have, however, been built and flown, and are briefly discussed in the following paragraphs. It will be noted that in the main the French helicopter designers have not kept to the beaten track, but have set out to explore some new principle, or to simplify the controls or the general construction.

A French jet-driven-rotor design, the S.O. 1110.

Smallest of three helicopters developed for the Ministry of Supply programme : the Bristol 171.

Since Louis Bréguet built his record-breaking research helicopter in 1936, using two contra-rotating co-axial rotors, he has continued with this configuration. The current design, the GIIE, is a small three-seater of 3,100 lb gross weight with a 260 h.p. engine. There is no particular novelty except in the governor which controls the collective pitch of the rotors. This governor is sensitive to both angular speed and positive acceleration, and controls a hydraulic jack, which moves the swashplates axially. The arrangement removes the lag inherent in ordinary centrifugal governors, since it increases pitch immediately on the slightest acceleration of the rotors. An override device is also provided, so that in a forced landing the pilot can manually increase pitch to use the rotor kinetic energy.

The S.N.C.A. du Centre have built a five-seater weighing some 6,000 lb, and with a 575 h.p. engine, which is of the twin inter-meshing rotor type. The special feature is that the pitch-changing hinge of the blades is similar to that of the Bristol Type 171 already mentioned, in that the hinge is provided by a combination of cylindrical torsion-bar and mechanical and rubber buffers. The torsion bar in this case carries only part of the centrifugal load, the rest being taken by the two sets of buffers.

The S.N.C.A. du Sud-Est began helicopter work by building the Focke-Achgelis Fa 223, of which parts were available in France after the Occupation, and then commenced the design of another type, originated by Professor Focke, which was to be a large, twin-engined, single-rotor type, with twin tail rotors at the tail, as discussed earlier. A small single-seater was built and flown as a "scale model" of the ten-seater design. This model has now been redesigned as a two-seater general utility type, weighing 2,200 lb and with a 200 h.p. engine.

The S.N.C.A. du Nord undertook the design, as a private venture without any direct State assistance, of a special helicopter incorporating several novel arrangements to simplify construction and control. The rotor consists of two main blades, with two auxiliary blades somewhat similar to those of the Hiller 360; but as distinct from the American design the auxiliary blades are also of the flapping type, and are so coupled to the main blades as to regulate the pitch of the latter in such a way as to reduce their flapping. This partial suppression of the flapping of the main blades reduces vibration at high speed and stabilizes the rotor. The auxiliary blades are so mounted as to be free to move axially on their pitch-changing hinges, this motion being restrained by springs. The blades are also coupled to the

THE HELICOPTER . . .

main blades in such a way that any extension of the auxiliary blades results in an increase in pitch of the main blades. By suitable choice of springs and linkage the designer has achieved a constant-speed rotor in which collective pitch is always properly co-ordinated with throttle opening. The pilot has an override collective pitch lever which controls the radial displacement of the blades.

The control system is novel in that vertical and horizontal tail surfaces mounted within a ring cowl, and in the slipstream from an ordinary fixed-pitch airscrew, provide torque compensation and directional and longitudinal control. The torque compensation is automatic, since the deflection of the vertical surfaces is controlled by a hydraulic torque-measuring device on the rotor mast. Lateral control is obtained by displacing the rotor head on a parallel linkage, and a similar movement in the fore-and-aft sense is used to trim for varying c.g. position.

The other point of interest is the blade construction. Each blade, which is of constant chord from root to tip, is built up of a solid duralumin spar and duralumin ribs, with a duralumin-sheet skin. These components are assembled by clamping together, and no bolts or rivets are used except at the hub attachment-fitting. This gives an exceedingly simple construction adapted to mass production by unskilled labour, and a blade which is good from the fatigue point of view.

The S.N.C.A. Sud-Ouest have devoted their attention to the jet-propelled rotor, and have built two experimental two-seaters using the central-pressure method of providing the reaction jets at the blade tips. The second model weighs 2,475 lb with a useful load of 880 lb, and the engine that drives the compressor develops 200 h.p. A further three-seater model, intended as a general-purpose type, is under development. In this case the compressor is driven by a small 200 h.p. gas turbine, so increasing the useful load to the very high figure of 57 per cent.

Helicopter development had started in this country before World War II. Substantially at the same time, and quite independently, the firm of G. and J. Weir had built and flown a small side-by-side twin rotor helicopter employing exactly the same principles as the Focke-Achgelis Type Fa 61, which is usually looked upon as being the world's first practical helicopter. Further development in a bigger size was proceeding but had to be abandoned early in the war.

In 1945, when technical resources again became available, the Ministry of Supply sponsored a programme covering three sizes of helicopter: the Bristol 171, a four-five-seater of 5,220 lb gross weight with a 500 h.p. Leonides engine; the 173, a 12-14-seater weighing 10,000 lb and using two of the type 171 rotors and power units in a tandem configuration; and the Cierva three-rotored Air Horse, of 17,500 lb gross, of which 4,500 lb is payload when carrying fuel for a range of 140 miles. Artists' impressions of the Bristol 173 have appeared in recent issues of *Flight* (December 28th and January 4th) and the other two machines have been fully described and do not call for comment here. The significant point to note in this programme is that all three sizes were obtained without the need for going outside existing knowledge by having to explore the problems of increasing rotor size. Thus, all the rotors were within the range of 48ft to 52ft diameter, thus catering for between 5,000 lb and 6,000 lb lift per rotor, and the basic unit weight was doubled or trebled by using two or three rotors.

In addition to these three types, the Fairey Aviation Co. exploited the Gyrodyne principle as a private venture.

Currently, the Bristol 171 is in small production, the Bristol 173 is reported to be in the final assembly stage and should shortly begin flight trials, and the Air Horse is continuing development trials. The Air Horse in its present form is only single-engined, but in conformity with the British view that the helicopter for civil operation between city centres must be multi-engined, various twin-engined development layouts are being studied.

The jet-propelled helicopter is recognized as an important future development and, while no disclosure of activities in this direction has been made, it is understood that several constructors are engaged in developing more efficient jet devices for application to rotor blades.

PLANING-TAIL HULL

INCREASED safety for amphibious aircraft while waterborne, and improved flight performance, are claimed as a characteristic of the newly developed N.A.C.A. "planing-tail" hull, as a result of water and flight tests conducted by Goodyear Aircraft Corporation.

For the tests, the hull of one of Goodyear's GA-2 amphibians was converted to incorporate the deep, pointed step and long afterbody characteristics of the planing-tail hull. The new-type hull is incorporated in the latest Goodyear GA-22.

VAMPIRE MK. 53

THE name Mistral has been conferred on the S.N.C.A.S.E.-built Vampire Mk. 53, developed from the Mk. 51 and similarly powered with the Hispano-Suiza-built Rolls-Royce Nene. In the development of the type collaboration of S.N.C.A.S.E. with de Havilland, Rolls-Royce and Boulton Paul has been richly rewarded. Almost entirely French-equipped, the Mistral has an ejector seat, and should prove 46 m.p.h. faster at sea-level than the Mk 51. Rate of climb should be improved by 35 per cent.

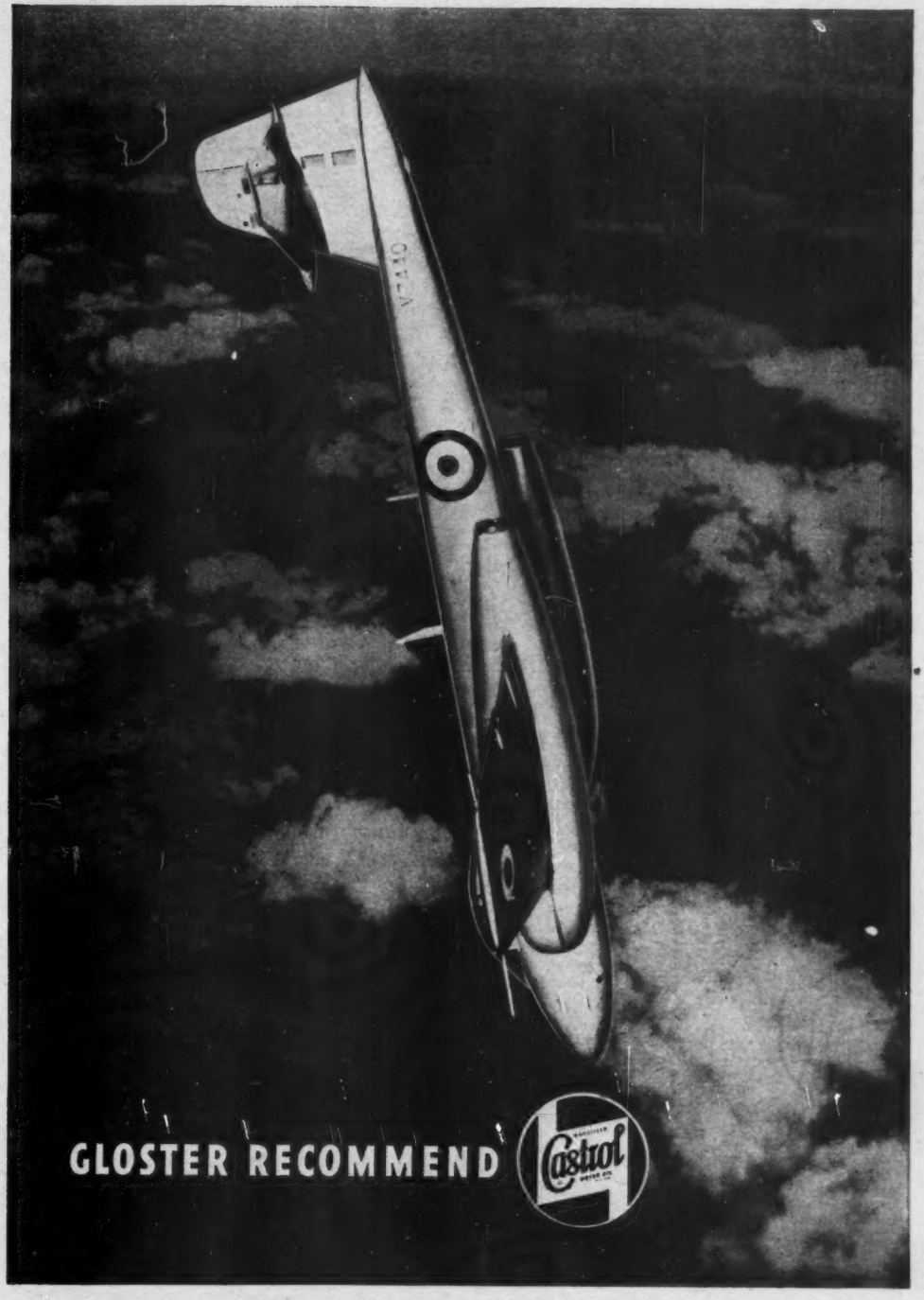
THIRTY YEARS of GOODWILL

MR. H. ("JERRY") SHAW, of the Shell Petroleum aviation department, was recently presented with a memento "as a token of affectionate appreciation of over 30 years' unstinting help given to his fellow aviators."

Some 200 of his friends in the aviation world—mainly airline executives, pilots and ex-pilots—subscribed; they also signed their names in a book which, with the trophy, was handed to Mr. Shaw by Mr. J. W. S. Brancker of B.O.A.C., at a party given at the Royal Air Force Club, with Sir Alan Cobham as host.

The idea originated with Maj. Woods Humphrey, Imperial Airways chief from 1924 to 1938, who referred to Jerry Shaw as "the most skilful aerial hitch-hiker of all time." The memento is in keeping with that sentiment; executed in bronze, it consists of a hand making the hitch-hiker's sign and bears the inscription "That's Jerry, that was." The rather modernistic hand, actually, is a double one, suggestive of the head in the famous Shell advertisements associated with the slogan.

At the presentation to "Jerry" Shaw, referred to above: (Left to right) The recipient, with memento; Mr. J. W. S. Branker, and Captain Gordon Store (B.O.A.C.); Major J. L. B. H. Cordes (G.A.P.A.N.), Capt. John Stocks (M.C.A.), Mrs. Cordes.


GLOSTER RECOMMEND
Castrol

THE NEW CHRISLEA CH3 (SERIES 4)

SKY JEEP

THE Chrislea Sky jeep's high manoeuvrability and fine turn of speed were amply proved in the 1950 Goodyear Trophy Race, when it was flown to a brilliant victory by Mr. D. Lowry, Sales Manager of the Chrislea Company.

IS EQUIPPED WITH GOODYEAR MAIN WHEELS AND SINGLE DISC HYDRAULIC BRAKES

(Goodyear Crosswind Landing Gear can be fitted on demand)

THE Single Disc Brake was first introduced by Goodyear several years ago. Since then the knowledge gained from actual operating experience has been vigorously applied, and to-day the Goodyear Disc Brakes have a reliability unique in the field. They give the pilot real confidence in landing, and sensitive control in every ground manoeuvre.

- SIMPLE CONSTRUCTION
- SIMPLE ACTION
- SIMPLE OPERATION
- EASY MAINTENANCE
- AUTOMATIC LINING ADJUSTMENT
- RAPID HEAT DISSIPATION

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THE CURTAIN PARTS

Details of Mig-15 and Lavochkin Fighters Shown in Newsreel

ONE of the earliest, and two of the latest, types of Soviet single-jet fighter are to be seen in an excerpt from a Russian newsreel, captured in Korea and included in a recent edition of *Gaumont-British News*.

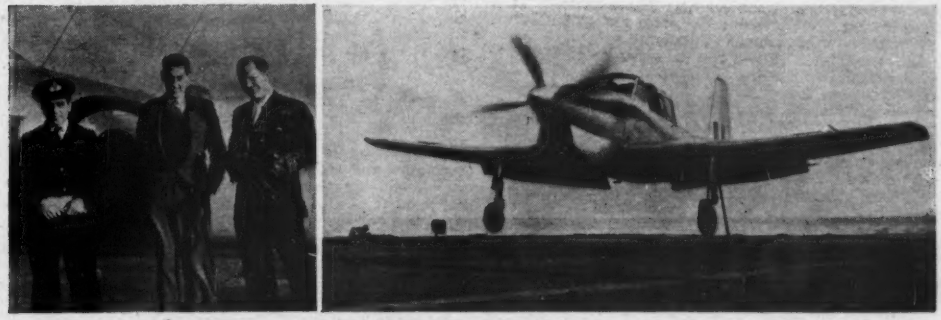
Two formations of Yak-15s—now, it is believed, relegated to the training ranks of the Soviet Air Force—are shown, and, although this type has been in service since 1947, these shots are probably the best yet seen of this early Russian venture in the turbojet era. Nothing new can be learned, however, apart from the fact that the aircraft retain camouflage markings, whereas the two latest types—the Mig-15 and Lavochkin fighters—are in natural metal finish. Resemblance of these types to the North American Sabre is thereby enhanced.

The Lavochkin (designated La-17, according to foreign reports) is shown taking off from an airfield in the Russian Zone. It is seen to be of high-wing design with sharp sweepback on all flying surfaces and a conventional "blister" cockpit hood. A fairing beneath the rear fuselage ends abruptly, level with the jet orifice, and might house a rocket for take-off and combat, though there is no confirmatory evidence. The high positioning of the wings is one of the very few features distinguishing the La-17 from the other new Soviet fighter, the Mig-15, which is a mid-wing type.

A few new details of the Mig-15 revealed by the film include two boundary-layer "fences" on each wing, roughly dividing the leading-edge into thirds. Also, two different armament schemes are seen. In both, the guns are mounted in the fuselage beneath the nose intake, but in one there is a large-bore (possibly 30 mm) gun on the port side and a smaller (20 mm?) weapon to starboard, whereas in the second layout there appear to be four guns—probably 20 mm—protruding from the lower-side of the nose, two on either side of the nosewheel housing. Rear-fuselage dive-brakes, protruding from each side of the fuselage just behind the Red Star markings, are seen in use during a landing approach.

The finale to this all-too-short flying sequence shows the Mig-15 in combat with an American fighter over Korea. The commentator has it that the American aircraft is a Panther—whereupon a close-up of the nose of a Lockheed F-80, with all guns firing, is screened. But the standard of photography, and very welcome glimpses of the latest additions to Russia's fighter strength, allow a charitable view to be taken of this lapse.

BALLIOL ON THE DECK : NAVAL INTEREST IN AN R.A.F. TRAINER



After simulated trials at the R.A.E., Farnborough, and at the A. and A.E.E., Boscombe Down, two Boulton Paul Balliols have completed intensive deck-landing trials on board the Fleet carrier H.M.S. "Illustrious." The three pilots concerned in the trials were (portrayed above, from left to right), Lt. Pridham-Price, Mr. P. B. Mancus (Boulton Paul test pilot), and Lt. Cdr. Orr-Ewing. The Balliol has a Rolls-Royce Merlin 35 engine.

FORTHCOMING EVENTS

Jan.	20.	Aircraft Recognition Society: Hurricane Trophy Competition.
Jan.	23.	R.Ae.C. : Talk on Korea by William Courtenay, O.B.E., M.M.
Jan.	23.	R.Ae.S. (Glasgow) : Brains Trust.
Jan.	24.	R.Ae.S. (Luton) : Film "Steel Making and Usage."
Jan.	27.	Society of Licensed Aircraft Engineers : "Rocket Propulsion and Interplanetary Flight," by John Humphries, B.Sc.(Eng.), A.M.I.Mech.E., A.F.R.Ae.S.
Jan	30.	Society of Instrument Technology : "Machining of Small Instrument Parts," by K. J. B. Wolfe and P. Spear.
Jan.	31.	R.Ae.S. (Weybridge) : "S. F. Cody," by G. A. Broomfield.
Jan.	31.	Royal United Service Institution : "Campaigning in Korea." —Film and Commentary by William Courtenay, O.B.E., M.M.
Feb.	1.	British Institution of Radio Engineers (Scottish Section) : "Multi-station V.H.F. Systems using Frequency Modulation," by W. P. Cole, B.Sc. and E. G. Hamer, B.Sc., A.M.Brit. I.R.E.
Feb.	3.	British Interplanetary Society : "Interplanetary Orbits," By Dr. J. G. Porter, Ph.D., F.R.A.S.
Feb.	6.	R.Ae.C. : Colour Film of Korean Campaign, by William Courtenay, O.B.E., M.M.
Feb.	7.	R.Ae.S. (Luton) : "Interplanetary Travel," by A. Clark, B.Sc.
Feb.	7.	Royal United Service Institution : "Flying-boats in war," by A. V-M. P. H. Mackworth, C.B., C.B.E., D.F.C.
Feb.	14.	R.Ae.S. (Brough) : "Aero Engines," by A. Cdre. F. R. Banks, C.B., O.B.E.
Feb.	14.	R.Ae.S. (Preston) : "Testing Aero-engines and Power Plants," by A. C. Lovesey, O.B.E., B.Sc., F.R.Ae.S.
Feb.	19.	Institute of Welding (South London Branch) : Visit to R.A.E., Farnborough.
Feb.	21.	R.Ae.S. (Weybridge) : "Air Interception," by A. V-M. T. G. Pike, C.B., C.B.E., D.F.C.
Feb.	21.	British Institution of Radio Engineers : "Electronics and Air Transport," by C. H. Jackson, B.Sc., A.F.R.Ae.S., A.M.I. Mech.E.
Feb.	22.	Institute of Metals (Birmingham Section) : "Metals for Gas Turbines," by J. M. Robertson, Ph.D., D.Sc.
Feb.	22.	R.Ae.S. (Glasgow) : "Thin-walled Structures", by Dr. R. M. Kenedi, Ph.D., A.M.I. Mech. E., A.F.R.Ae.S.
Feb.	23.	R.Ae.S. : Fourth Louis Blériot Lecture : "Power versus Weight" by M. Maurice Roy.
Feb.	24.	Society of Licensed Aircraft Engineers : "Accident Investigation," by A.Cdre. Vernon Brown, C.B., O.B.E., M.A., F.R.Ae.S.
Feb.	27.	R.Ae.S. (Belfast) : "Aircraft Carriers," by J. L. Bartlett.
Mar.	3.	British Interplanetary Society : "Combustion in the Rocket Motor," by Prof. A. D. Baxter, M. Eng. A.M.I.Mech.E., A.F.R.Ae.S.
Mar.	5.	Institute of Transport (Metropolitan Section) : "Air Transport by Charter Companies," by Capt. R. J. Ashley.
Mar.	7.	Royal United Service Institution : "The Campaign in Malaya," by A.V-M. Sir Francis Mellersh, K.B.E., A.F.C.
Mar.	7.	R.Ae.S. (Preston) : "Air Operations in the 1914-18 War," by Capt. Norman Macmillan, M.C., A.F.C., A.F.R.Ae.S., F.R.S.A.
Mar.	7.	R.Ae.S. (Luton) : "De-icing and Anti-icing Systems," by D. Rendel, B.Sc.
Mar.	8.	Institute of Welding (South London Branch) : "Welding Thin-gauge Stainless Steel," by C. Colley.
Mar.	13.	R.Ae.S. (Belfast) : "Padar," by B. W. Hodlin, B.Sc. (Hons.).
Mar.	14.	R.Ae.S. (Brough) : "Aircraft Structures," by P. B. Walker, M.A., Ph.D., F.R.Ae.S.
Mar.	14.	R.Ae.S. (Weybridge) : "Turbine-engined Aircraft," by G. R. Edwards, M.B.E.
Mar.	16.	Institute of Transport : Annual Dinner.
Mar.	22.	Institute of Metals (Birmingham Section) : "Adhesives for Metals," by C. J. Moss, B.Sc.
Mar	22.	R.Ae.S. (Glasgow) : "Gas Turbines" by L. Haworth, B.Sc. A.M.I. Mech.E.
Mar.	28.	R.Ae.S. (Preston) : Lecturettes.
Mar	31.	Society of Licensed Aircraft Engineers : Brains Trust.
Apr.	4.	R.Ae.S. (Weybridge) : "Gas Turbines," by Dr. S. G. Hooker O.B.E., A.R.C.Sc., B.Sc., D.I.C., D.Phil., F.R.Ae.S., F.R.S.A.

SERIAL NUMBERS

How Individual British Military Aircraft are Identified : The History of a System Inaugurated 38 Years Ago

By M. J. F. BOWYER

ALL R.A.F. and Naval aircraft carry a serial number allotted when a contract is placed with a manufacturer or when the aircraft are purchased. A method of identifying each airframe became an obvious necessity when the Army began to adopt aircraft in 1912, and so each machine was given a number starting at 1 and following through to 9999. Originally the Air Battalion R.E. was responsible for operating aircraft, but on May 13th, 1912, the Royal Flying Corps came into being, having a Military and Naval Wing. The latter changed its name to the Royal Naval Air Service in 1914, and at the same time took over all airships from the Army.

Numbers 1 to 200 were allotted to the Naval Wing and 210 onwards were allotted to the Army. When the Naval Wing used up its first block, it was allotted a second batch, 801 to 1600 inclusive; 1601 to 3000 and 4001 to 8000, both inclusive, were Military aircraft, whilst 3001 to 4000 and 8001 to 9999, both inclusive, were Naval aircraft. It is believed that numbers above 9999 were allotted but I have no definite information upon this point.

When number 9999 was reached—or a number slightly greater, assuming that five-figure numbers existed—it was decided to place an alphabetical letter preceding the number to prevent the numbers from becoming too great. A second series began at A1 and ran through to A9999, followed by a third, B1 to B9999, etc. Allocation of serials was rapidly speeded up as the immense value of the aeroplane in war was realized. Series prefixed "C," "D," "E," "F" and "H" were allotted, running through in each case from 1 to 9999. "G" series was reserved for captured German aircraft, whilst "I" was not used, to prevent confusion with the number one.

When the letter J was reached it would seem that the first number allotted was J1000. It is true to say that no machine ever appeared with a number prefixed by "J" between 1 and 999. By the end of the 1914-18 war J1100 was approximately the number reached, but few aircraft between J1000 and J6700 were actually built, and many contracts were cancelled due to the completion of hostilities.

The remaining "J" numbers 6700-9999 were used up between 1919-1927—a true indication as to how the industry suffered then.

Upon the formation of the R.A.F., on April 1st, 1918, a new series prefixed "X" and beginning at 1 was introduced for experimental aircraft, but this was a very short-lived series, soon dispensed with.

When 9999 had been reached in the first series, all new Naval aircraft were then allotted a number prefixed by the letter "N." R.N.A.S. aircraft numbered between N1 and N499 were prototypes (e.g., N163 was a Fairey Flycatcher, and N164 was its seaplane version). Whilst N1 to 499 was left for prototypes, the whole batch was never used up, the highest number being about N263. Numbers from N500 were reserved for deck-landing aircraft prototypes, whilst R.N.A.S. production aircraft had serials commencing at N1001. N9999 was reached in about 1924, and a new series for Fleet and Coastal Area aircraft commencing at S1001 was allotted, but in 1931 this was discontinued, and since that time Naval and Coastal aircraft have received no special series to themselves.

It is interesting to note that in 1919 civil aircraft were allotted a series beginning K100, but they terminated at K175 because the present system of registration letters was introduced late in 1919.

"K" numbers commenced in 1927 with K1000, and each successive series began at 1000 and terminated at 9999. Single-letter prefixes used were K, L, N, P, R, T, V, W, X and Z. "K" numbers were still being issued when the R.A.F. expansion scheme was introduced in the mid-1930s, and many wartime types had prototypes in the Ks (e.g., K4049 and K4212, Wellington prototypes; K5054, Spitfire; K5083, Hurricane; K4586, Whitley; and K6127, Lysander). The "Ls" were all expansion types, with few exceptions, these being prototypes of aircraft which emerged during the early stages of the war (e.g., Stirling, L7600; Lancaster, L7502; Lerwick, L7248; and Whirlwind, L6844). It was during the K and L series that the "blocking-out" system was introduced. An example will show the meaning of this phrase. Auster Mk. 1 aircraft were of the double-serial letter sequence (referred to later) and extended from LB263 to LB385, inclusive. Therefore, one might assume that 123 Austers Mk. I were built in this contract batch. But certain numbers were "blocked out" and small batches within the larger group only were produced, these being LB263 to LB299, LB311 to LB352 and LB365 to LB385. Total production was thus 100 machines and not 123. Only by knowing these "break-downs" of batches would an enemy be able to assess actual production, and this is the reason for the "blocking-out" system. It did not, however, apply to wartime American aircraft used by the R.A.F.

Prior to the last war, certain aircraft were rebuilt from, for example, a Naval to an R.A.F. type (e.g., Fairey IIIF to Gordon). When this was done a letter "R" appeared after the original prefix letter and preceded the number.

Z9999 brought an end to the single-letter series, and so a new system, using two letters followed by three numbers, was introduced at AA100. As there are so many combinations, it is not proposed to deal with each of them. Numbers ran in each series from 100 to 999, being, of course, "blocked out" in many cases. First letters used in combinations so far have been A, B, D, E, F, H, J, K, L, M, P, R, S, T, V and W. Second letters used have been A, B, D, E, F, G, H, J, K, L, M, N, P, R, S, T, V, W, X and Z. Within these, certain combinations were not used, such as DA, DB, EA, ET, HA, HT, JE, JH, MR, NW, NZ, SV, TN and TR. NC were letters used by Wellingtons, but "C" appeared nowhere else in these letters. EV to HD inclusive and JS to KP, were Lease-Lend aircraft; SA to SK were allotted to Lease-Lend aircraft but were never taken up, due to the end of the war.

Suffixes were used during the war to indicate various categories of individual aircraft; as an example of this, SNAKE was one coding, and this gave the clue to what type of equipment was carried (although not such an obvious clue as one might think!).

[*The foregoing article is from a recent issue of "Aircraft News," published by Auster Aircraft, Ltd.—Ed.*]

ALL-SWEDISH TURBOJET

A STOCKHOLM announcement claims that Sweden will be the first of the smaller nations to produce a turbojet of domestic design, collaboration to that end having already been initiated between the STAL (Svenska Turbinfabriks AB Ljungström) concern, of Finspang, and Svenska Flygmotor AB, a subsidiary of the SAAB Aircraft Company. The new unit is of axial-flow design, and is intended for a SAAB fighter to supersede the J-29, now in service with the Swedish Air Force. All technical data are withheld, but it can be said that the thrust will be considerably higher than the 5,000lb delivered by the de Havilland Ghost, installed in the J-29 and built under licence by Svenska Flygmotor.

W. A. ROLLASON'S MOVE

IN a recent paragraph in these pages concerning the location of the offices of W. A. Rollason, Ltd., and Rollason Engines, Ltd., it should have been made clear that the head office has been moved *from* Terminal House, Victoria, *to* Croydon Airport, Surrey. The telephone number is Croydon 5151/3.

BIG AIRCRAFT, BIG HEADLINES

ALTHOUGH there has been little or no change in plans, the Brabazons and Princesses last week found themselves front-page news once again. Unfortunately for the sponsors of these huge aircraft—ordered in more hopeful times nearly five years ago—whatever course was, or is, taken, it is likely to be described as wrong. For the record, the position and facts must be stated so far as they are known: Two Brabazons have been ordered, one—now flying—with piston engines, another, an improved version with Proteus turboprops, due to be completed in rather over a year's time. It was hoped that B.O.A.C. might eventually operate a few turbine-powered "Brabs" (more correctly Type 167 Mk II) on the direct North Atlantic crossing, but there has never been any obligation or undertaking to do so. The Brabazon prototype was intended solely for research, and that remains the intention. The second, Proteus-powered, version is not now likely to operate or be followed by others.

It is believed that in much the same way as B.S.A.A. once offered to operate Princess flying-boats on a no-loss arrangement with the government, so B.O.A.C. were willing to consider operating, say, three 167s for national prestige and experimental reasons, provided any losses incurred were made up to the Corporation. The same is believed to be true of the Princess boats, of which three were originally ordered. If, in fact, one Princess is now to be cancelled to save abput £1 million, this will greatly reduce the chances of the other two seeing airline service, it being almost impossible to run a long-range scheduled service without a reserve.

Both the Brabazons and the Princesses are providing, and will continue to provide, a great deal of valuable research data, while a correspondent this week (see page 86) makes the point that such aircraft can, as past experience has shown, do invaluable work in war-time. On the credit side, also, must now be reckoned the experience gained in producing Brabs and Princesses and the keeping together of design and manufacturing teams during thin times; this may prove to be of the greatest value to the country in the coming months. Nor should it be overlooked that the assembly hall at Bristol has proved a godsend to B.O.A.C., and that the huge Filton runway has more uses than simply to launch and receive back the Brabazon. All are important national assets, worth a mountain of monkey nuts!

Startling headlines in a London daily last week have provoked a sober statement from the Bristol Aeroplane Company; an extract is as follows: "All that has happened recently is that, on a review of the project some weeks ago (carried out, it is believed, by the Cabinet Sub-Committee concerned) the existing position was reaffirmed—itself sufficient evidence of the high opinion of the continued outstanding technical promise of the project held by those qualified to judge. In the circumstances of to-day considerations other than those of technical merit must often be the criterion of policy."

PREVENTING CONTROL-REVERSAL

MR. J. R. RADDINGS, an employee of Saunders-Roe, Ltd., is the inventor of a device to prevent incorrect assembly of aircraft controls, which has been adopted by the S.B.A.C. as a standard safety measure. Correct assembly of chain and sprocket is ensured by the fact that the chain carries a small projection which mates with a slot in the sprocket. Chain-inversion—which would otherwise defeat the purpose of the device—is precluded by the use of a close-fitting guard. Incidentally, an earlier design of safe-assembly control chain by the same inventor was described in *Aircraft Production* for March, 1948. European rights for the latest Raddings device have been sold to the Renold and Coventry Chain Co., Ltd.

GEARING UP

LAST week we referred to the turn-over of the vast Willow Run (Detroit) factory from the manufacture of Kaiser-Frazer cars to the construction of aircraft—probably Fairchild C-119 Packets. Now comes the news that F-84s are to be built at the Buick-Oldsmobile-Pontiac assembly plant of General Motors in Kansas City, car production gradually being tapered off.

Yet another car firm, Chrysler, is also being brought into the rearmament programme: Pratt and Whitney have arranged for Chrysler to build the J-48 turbojet, which, with its basic rating of 6,250lb thrust, is America's most powerful gas turbine in service. (The J-48 is, of course, the Rolls-Royce Tay as built under licence.) Manufacture will begin at a new works near Detroit.

Last September P. and W. licensed the Ford Motor Company to build their big piston engine, the R-4360 Wasp Major.

NEW A.W. DIRECTOR

THE appointment is announced of Mr. S. W. D. Lockwood, O.B.E., A.M.I.P.E., to the board of Sir W. G. Armstrong Whitworth Aircraft, Ltd. He will occupy the post of works director.

Mr. Lockwood joined the design staff of Armstrong Siddeley Motors in 1921, and was later assistant designer, wings and control surfaces. In January, 1940, he was transferred to the A.W. works staff, and was assistant works manager during the company's production of the Whitley and the Avro Manchester. He was next appointed production manager, and was largely responsible for organizing the change-over, in 1943, to the manufacture of Lancasters. He was responsible for yet another works reorganization when the Lincoln went into production in 1945. His inclusion, as an O.B.E., in the 1948 Birthday Honours List was mainly in recognition of these important services.

Mr. Lockwood was also responsible for the production, in record time, of the Armstrong Whitworth "flying wing" research aircraft, in which the use of a laminar-flow wing raised a number of unusual constructional problems. He was appointed works manager in 1944.

THROTTLE BENDERS' UNION IN SESSION : BADGE ADOPTED

"Flight" photographs

Last Friday the "Throttle Benders" met at Ciro's club with Nat Somers in the chair. There are but six (founder) members of this exclusive union. To qualify, one must be a regular racing pilot and have won one of the classic races. Left to right: A. L. Cole, Col. Preston (R.Ae.C. Secretary-General), J. Rush, F. Dunkerley, J. N. Somers and R. R. Paine. C. G. Alington was the only member absent.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Dead Losses or Potential Assets?

IF one can judge from a banner-headed daily-paper report I have just laid down with a certain distaste, the Brabazon has overnight become a total loss. Like Tom Bowling, this great form, of manliest beauty, the darling of her crew, lies a sheer hulk, labelled no longer "Queen Mary of the Air," but, damningly, "Research project."

But who can tell that the Brabazon I and II are not still potential assets which, in time of war, might be seen disgorging troops and supplies behind some hard-contested battle line; in fact, rendering the same valuable, silent service as did the H.P.42s, Ensigns and other civil stalwarts active in the early 'forties?

I am not aware that the U.S.A.F. regrets its ownership of a single Brabazon-sized Convair XC-99, so why should we bemoan so dismally a brace of Brabazons? And if, as I believe possible, the third Saro Princess is cancelled, and the commercial operation of these great boats is thus rendered near-impossible, could not the remaining two serve out their time with the R.A.F., as did the Short Sarafand, a "monster" of years gone by?

JOHN ELLIOT.

Bedford.

Historic Aircraft

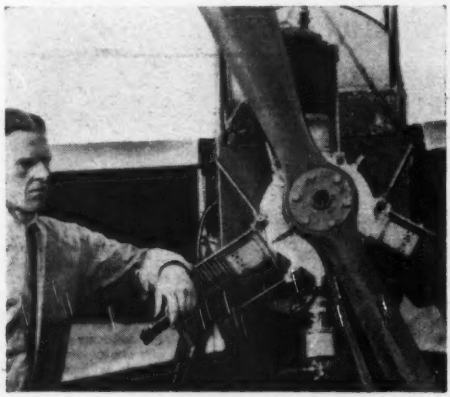
ALTHOUGH I only started to take an interest in aircraft in about 1930, I heartily approve of the remarks by Mr. A. H. Curtis in his article "Unfair to Veterans" (*Flight*, December 21st). The hours of joy which "504s" have given me will always remain in my memory.

Modern fighter aircraft can manage a much enlarged version of nearly all the aerobatics performed by such aircraft as the 504, but how many could manage the effort of a Le Rhone 504 which spent most of a sunny afternoon over Birmingham diving to about 1,000ft, doing a very tight half loop, with full rudder applied at the top, resulting in the completion of the other half of the loop at right angles to its original course?

Birmingham, 24. F. H. COATES.

I HAVE read with great interest the recent correspondence in *Flight* on historical aircraft and, in particular, Mr. A. H. Curtis's article "Unfair to Veterans" in the issue of December 21st.

I agree with Mr. Curtis, but it appears that he has overlooked one point in connection with the Shuttleworth Deperdussin. I refer to the engine fitted when Mr. Edmunds flew circuits and he (or the late R. O. Shuttleworth) reached approximately 1,000ft at Heathrow in 1937. The motor then used was a Y-type Anzani rated at 35 h.p.—the extra seven or so horsepower being obtained from auxiliary exhaust ports drilled in the cylinder walls. The additional power makes all the difference to the performance and it was with some surprise that, at White Waltham, I found the Dep. fitted with "new" cylinders without these ports.



Auxiliary exhaust-ports in the Y-type Anzani: This is a section of the 1913 "Flight" photograph referred to by Mr. E. J. Arnsby, showing W. L. Brock with his 35 h.p. Deperdussin.

So far as I can remember, *all* the many "Y" Anzanis (with one exception) in use at Hendon from 1912 to 1916 had auxiliary ports. Your photograph in *Flight* of November 8th, 1913, of W. L. Brock in front of his 35 h.p. Dep. clearly shows them in the cylinder walls. [Part of the picture is reproduced here.—ED.] In the adjacent paragraph you mention that on this machine Brock reached 4,300ft, and descended again, in 35 min. In the same aircraft, on April 5th, 1913, he flew from Hendon to Brooklands in a 40-55 m.p.h. gale.

Regarding the Avro 504K, may I correct Mr. Curtis's figures for Raynham's famous 20-mile glide? He cut off his engine at 15,000, not 10,000ft, and the date was February 4th, 1914. The machine was one of the first Avro 504s (80 h.p. Gnome).

London, S.W.7. E. J. ARNSBY.

Why So Few?

IN the January 4th issue of *Flight* (page 5), under the heading "Cause for Concern," there are quoted the F.A.I.-compiled statistics of the numbers of people practising private flying in six countries. Taken at their face value, the figures are, to say the least, surprising. Putting them in a more forceful form, i.e., by totals of population per private pilot, we get:—

Switzerland ..	708 per pilot	United States	6,166 per pilot
Denmark ..	715 " "	Italy	6,571 " "
The Netherlands	2,666 " "	Britain ..	14,727 " "

Why is Britain (quoted by the F.A.I. as having only 3,300 private pilots) so easily bottom of the list? Considering the fairly long lists of new R.Ae.C. Aviators' Certificates which appear in your columns from time to time it is apparent that of those who obtain pilots' licences a large proportion must ultimately let them lapse, leave the country or fade away, otherwise the cumulative build-up would surely result in a more impressive figure. This is assuming that by "people practising private flying" the F.A.I. means those who, either in their own or in club-operated aircraft, fly a certain number of hours each year and consequently retain current licences.

Probably the most immediate cry will be, "the high cost of flying in Britain"; but desirable as may be the reduction of costs, and despite the complete lack of any real form of practical assistance from the Government, can we honestly say that it is any more expensive here than in most other countries? Mr. Golay, in his interesting article, "The Mountain and the Moth" (*Flight*, December 21st, 1950) tells of a £42 deposit by all flying members at the Lausanne Flying Club and a liability of £180 in the event of a total "write-off," in addition to normal flying time rates of £5 an hour (in itself a high figure by many British Club standards).

If the standard of life in any country is an index to its potential pilots, the United States should surely be above the European countries; and should Britain really be at the bottom on this basis, Mr. Attlee?

We must look a little further and see who are the practising pilots. In some cases they are successful business-men, and in others younger and more impecunious enthusiasts. The latter are the more obvious natural source, but to-day the more keen types can of course, join the A.T.C. and obtain so much free flying that the novelty wears off by the time they have become potential private pilots or, alternatively, join the R.A.F.—in which case they are not practising private pilots anyway. Of many of those young men who are able and willing to make personal sacrifices to achieve the status of private pilot, flying-club instructors have been heard to remark bitterly, "they go off and get married and that's the last we see of them."

Incidentally, on the subject of expense it would be interesting to have some figures on the sort of incomes that private pilots are practising on to-day.

No, we must face it: the facts are that, despite the ubiquitous Royal Air Force, and the immense skill and technical artistry of the Industry, we are not air-minded as a nation.

Southampton. ONE OF THE 3,300.

[Several additional factors, of course, have a bearing on the matter so far as this country is concerned—e.g., weather, inaccessability of airfields, and fuel and other taxes. Many Service pilots take out Private Pilots' Licences but do not fly as private pilots, and many other people use the P.P.L. only as a first step towards the various grades of commercial licence.—Ed.]

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

THE NAVY IS THERE: H.M.S. Theseus off the Korean coast. The ship is turning out of wind, having landed-on Hawker Sea Furies. Six Sea Furies (Bristol Centaurus) are seen, with folded wings, on deck, together with a Fairey Firefly (Rolls-Royce Griffon).

Home Command Reorganization

THE Air Ministry announces the appointment of A.V-M. Walter John Seward, C.B., C.B.E., as A.O.C. No. 61 (Eastern) Group, Home Command, and of A. Cdre. Charles William Gore, O.B.E., as S.A.S.O.

These appointments, which will take effect next month, follow a decision to combine No. 65 (London) Group with No. 61 (Eastern) Group. The A.O.C. No. 61 Group will take over responsibility on February 1st for all units in the present 65 Group area, which covers the City of London, the administrative county of London, and the county of Middlesex; this will be added to the counties of Bedford, Cambridge, Essex, Hertford, Huntingdon, Kent, Norfolk, Suffolk, Surrey and Sussex, hitherto covered by No. 61 Group. On the formation of the reconstituted 61 Group, with Headquarters, as at present, at Kenley, Surrey, all Groups of the newly named R.A.F. Home Command will cover areas equivalent to Army Command areas.

Among the units at present administered by No. 65 Group which will go over to No. 61 Group are the University of London Air Squadron; Nos. 81, 83 and 86 R.A.F. Reserve Centres, located in London and at Stanmore Park and Hornchurch respectively; Nos. 1, 15, 17 and 18 Reserve Flying Schools, at Panshanger, Redhill, Hornchurch and Fairoaks respectively; the Royal Auxiliary Air Force Air Traffic Control; the London, Blackheath, Ealing and Watford Recruiting Centres; and all A.T.C. units in the City of London and the counties of London and Middlesex.

New University Squadrons

THREE new University Air Squadrons —at Hull, Bristol and Liverpool— are to be established. They will operate respectively from Brough, Filton and Hooton Park, and will bring the total of University Squadrons to 17. The others are at Aberdeen, Belfast, Birmingham, Cambridge, Durham, Edinburgh, Glasgow, London, Leeds, Manchester, Nottingham, Oxford, St. Andrews, and Southampton.

Until recently, membership was for a period of five years, but this has now been reduced to the duration of a university course, except in the case of students who, before their acceptance into a University Air Squadron, were already in the R.A.F.V.R. or were liable for part-time National Service extending beyond the anticipated period of the university course.

New Light Fleet Carriers

IT is reported that the four light fleet carriers of the *Hermes* class, under construction for the Royal Navy for nearly seven years, are to be considerably larger than was at first expected. Work on these vessels is to be accelerated during 1951.

A.T.C. Efficiency Cup

NO. 398 (Staines, Mdx.) Squadron of the Air Training Corps has become the first winner of the A.T.C. Efficiency Cup, presented last year by Air Marshal Sir Alan Lees. Competing against 700 other squadrons, it came first in the final assessment, with a total of 1,263.6 marks. A close second was No. 1934 (4th Plymouth) Squadron, with 1,258 marks, and No. 461 (Chichester) Squadron was third with 1,183.3 marks.

Marks are awarded for recruiting and later careers in the R.A.F., administration training and sport. All squadrons with a cadet strength of 50 or more are eligible.

Malayan Operations

OPERATIONS by the R.A.F. against bandits in Malaya during December covered six States, with Johore receiving priority attention. Bad weather made target identification difficult, resulting in slight curtailment of effort; nevertheless, more than 350 sorties were flown, bringing the 1950 average to slightly over two air strikes per day throughout the year. Supply - dropping Dakotas parachuted nearly 360,000 lb of supplies to ground security forces, bringing the total for 1950 to over three-and-a-half million pounds. Helicopters of the Far East Air Force Casualty Evacuation Flight had the busiest month so far, lifting ten persons from jungle clearings and other spots inaccessible to normal aircraft. Aircraft of the R.A.A.F. and R.N.Z.A.F. continued to operate alongside the R.A.F. in all offensive supply and communications operations.

R.A.F. Regiment Demonstrates

EXERCISES in the Middle East are demonstrating what the R.A.F. can teach Britain's National Servicemen in the R.A.F. Regiment in the short space of two months' overseas service. At a recent exercise at the Geneifa firing range in the Canal Zone of Egypt, gunners of a R.A.F. Regiment Rifle Squadron, in half an hour of three-inch mortar firing, raked a target 2,000 yards distant, and showed how they can lay a smoke screen to cover advancing troops by dropping mortar bombs. After the exercise, men of the same Rifle Squadron took part in a miniature airlift operation from R.A.F. Station, Kabrit. Five Valettas were loaded with Regiment jeeps, motor cycles, and men to fly in formation to Port Said and back.

Navigation Training Flight

FIVE Lancasters from the R.A.F. Central Navigation and Control School were due to leave their base at R.A.F. Station, Shawbury, Salop, on January 15th, for a 10,720-mile training flight to Gibraltar, the Canal Zone of Egypt, the Anglo-Sudan and Kenya. Three days are to be spent in Nairobi. The homeward journey, starting on January 23rd, will be via Khartoum and Luqa (Malta). The round trip will take about a fortnight and the flight will give students practice in various navigation techniques and procedures. During the trip aircrews will exchange technical information with R.A.F. specialist navigators at refuelling points.

G/C. B. J. R. Roberts, Commandant of the School, is commanding the mission. His deputy is W/C. R. N. Wardell, Officer Commanding Flying, R.A.F., Shawbury. The aircraft carry servicing crews.

Sir Patrick Brind's Farewell

THE Commander-in-Chief of the Far East Station, Admiral Sir Patrick Brind, K.C.B., C.B.E., who shortly completes his appointment and returns to England, flew to Japan recently to say goodbye to officers and men of the British Commonwealth Fleet serving within his command in Korean waters. He visited ships and was able to congratulate the light fleet carrier *Theseus* on her splendid record of sorties flown in action against North Korea.

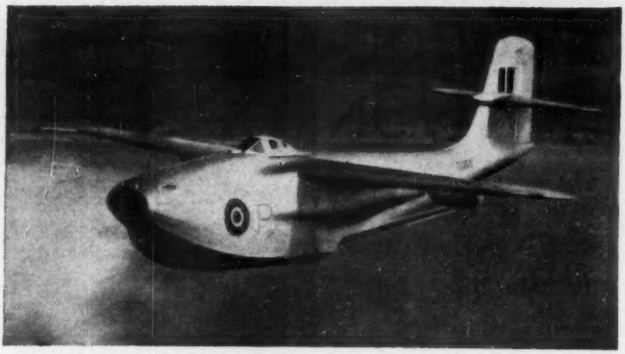
SERVICE AVIATION . . .

Naval Promotion

ALMOST simultaneously the promotion of Captain Caspar John, A.D.C., to the rank of Rear-Admiral, and his appointment to be Flag Officer Commanding Third Aircraft Carrier Squadron, have been announced by the Admiralty. In his new appointment (effective this month) he succeeds Vice-Admiral Charles E. Lambe, C.B., C.V.O.

During World War 2 Admiral Caspar John, an officer highly skilled and experienced in matters of naval aviation, held appointments in which he was able to play an important part in bringing the Fleet Air Arm to its peak strength. Between the wars he served in several aircraft carriers. He was posted to H.M.S. *Hermes* for full flying duties in 1926, and underwent deck-landing training with No. 440 Flight. Subsequently he served as a pilot in the *Argus*, *Furious* and *Courageous* and also had several periods of training with the R.A.F. A few years before the war he served in the Admiralty on the staff of the Naval Air Division and he made the first of several visits to America in connection with the development and expansion of naval aviation. Early in the war he served in H.M.S. *York* but returned to London in 1941 to become the Director General, and subsequently Chief Naval Representative, for naval aircraft development and production at M.A.P.

In 1943 he returned to the Admiralty to serve as Director of Air Warfare (Training), and shortly afterwards he left for Washington on an important mission. There he became the Head of the British Air Service representation in the U.S.A.; he served also as Naval Air Attaché and Assistant Naval Attaché, Washington. In October, 1944, Admiral John took command of H.M.S. *Pretoria Castle*, the Union Castle liner converted for use as an aircraft carrier. In the following year he commanded the light fleet carrier *Ocean* when she was first commissioned. In 1948 he was given command of the Royal Naval Air Station at Lossiemouth, Scotland; then he returned to the Admiralty to serve first as Deputy Chief of Naval Air Equipment and later as Director of Air Operations and Training. He is now on leave. The Admiral was mentioned in despatches in 1941 for zeal, resource and devotion to duty.



FIGHTING MARINER: The world's fastest marine aircraft is still the Saunders-Roe S.R.A.1 fighter (2 Metrovick Beryls), the first prototype of which flew on July 16th, 1947. Interest in the type is being maintained. The photograph here reproduced (in which a strengthened cockpit enclosure is seen) is from the Christmas card of Mr. Geoffrey Tyson, Saro chief test pilot.

Training in Canada

THE first 28 R.A.F. National Service pilots to go to Canada for training under a new scheme by the Royal Canadian Air Force were addressed by the Secretary of State for Air, Mr. Arthur Henderson, at R.A.F. Station, Uxbridge, on January 10th. The Air Minister said: "You are the forerunners of an increasing number of aircrew who will be training in Canada under the Aircrew Training Scheme which has been set up with the co-operation of the Canadian Government, and which was announced in August last year. Last week the Canadian Minister of Defence said it was the intention of his Government to offer increased training facilities to North Atlantic Treaty Nations. The British Government welcomes this offer. We intend to avail ourselves of these facilities and we hope to train in Canada, as soon as arrangements can be made, a substantial proportion of the increased number of pilots and navigators who will be required under the Government's re-armament programme. In going to Canada you will be going among friends, and I am sure that you will be welcomed with all the kindliness and hospitality which are characteristic of our Canadian cousins."

"Flight" photograph.

TROOP TRAIN, LEAVE BOAT, AMBULANCE, BUS SERVICE: A Dakota of No. 66 Transport Wing, R.A.A.F., emplaning passengers in Malaya. The Wing forms part of the air transport system of F.E.A.F. and, in addition to providing air ambulances for Korean and Malayan wounded, connects Singapore Island with Kuala Lumbur. Butterworth and the leave centre in Penang.

Western Union Appointment

GROUP CAPTAIN F. J. ST. G. BRAITHWAITE, C.B.E., who has for the past year been a student at the Imperial Defence College, has been appointed Chairman of the Air Advisory Committee, Western Union Military Staff Committee; he will hold the acting rank of Air Commodore. During the war A. Cdre. Braithwaite held posts connected with anti-shipping operations. On the staff of H.Q. Coastal Command as a torpedo specialist at the start of hostilities, he was, in June 1940, appointed to command No. 22 Squadron, the first R.A.F. squadron to have Beauforts.

In August, 1941, A. Cdre. Braithwaite took command of a torpedo training unit at Abbotsinch, and a year later, of an operational training unit for night torpedo attacks at Limavady. In April, 1943, he was appointed Deputy Director of Operations (Anti-shipping) at the Air Ministry. Nine months later he returned, as Station Commander, to North Coates which was then one of the three Coastal Command stations mounting the low-level Beaufighter strikes on German shipping. Since the war the Air Commodore has been successively Deputy Senior Air Staff Officer, H.Q., Transport Command, Air Adviser to the U.K. Delegation, Council of Foreign Ministers, and Staff Officer in Charge of Administration at Air H.Q., Malta.

R.A.F. Associations Merge

THE Royal Air Force Equitation Association, which exists to encourage horsemanship in the Service, has now joined forces with the R.A.F. Modern Pentathlon Association. Members of the R.A.F. are showing increasing interest in modern pentathlon events (riding, pistol shooting, cross-country running, fencing and swimming), and R.A.F. teams will now be organized by a sub-committee of the Equitation Association. The merger of the two organizations will result in the provision of more comprehensive training facilities for R.A.F. pentathlon competitors.

At the Equitation Association's recent annual meeting it was announced that the President's Cup (presented by Air Marshal Sir Aubrey B. Ellwood) awarded annually to the member who has shown outstanding keenness and progress in horsemanship, had been won by L.A/C.W. D. Chandler, W.R.A.F.

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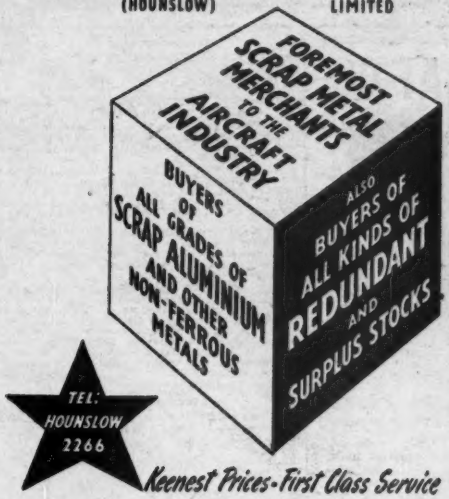
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"THE Elements of Aerodynamics and Fluid Mechanics" will be given at the College from MONDAY, 5th March, to Friday, 9th March, 1951.

THIS Course is a repetition of those given in May and October, 1949, and is intended to provide an ordered survey of the essentials of the subject for those new to it. Laboratory work and demonstrations will play an important part.

FEES for the course are: Tuition fee, 7½ guineas. Residence charge (including full board), 16/- per day.

COPIES of the syllabus and forms of registration can be obtained from the Registrar, The College of Aeronautics, Cranfield, Bletchley, Bucks. [5762

CITY AND COUNTY OF NEWCASTLE-UPON-TYNE.

APPOINTMENT of Airport Manager

THE Council of the City and County of Newcastle-upon-Tyne invite applications from persons with suitable experience for the post of Manager of the Council's Airport situate at Woolsington.

THE salary payable will be in accordance with Grade X of the scale of salaries fixed by the National Joint Council for Local Authorities' Administrative, Professional, Technical and Clerical Services (£850×£50—£1,000) and the appointment will be subject to the conditions set forth in the Scheme of that Joint Council.

FURTHER particulars of the duties attaching to the office may be obtained from the undersigned on written application being made and all applications for the post must be received not later than the 10th February, 1951.

JOHN ATKINSON, Town Clerk. Town Hall, Newcastle-upon-Tyne, 1. [5756

S. SMITH & SONS (ENGLAND), Ltd., Bishops Cleeve, Cheltenham.

REQUIRE the following staff:—

2 Senior draughtsmen for the design of light mechanisms, knowledge of aircraft instruments an advantage.

2 Junior draughtsmen for the detailing of aircraft instruments and electronic test equipment.

APPLY in first instance, Personnel Manager. [5750

EAGLE AVIATION have vacancies in their Luton establishment for the following:—

(A) Licensed radio mechanic, to control radio maintenance upon York aircraft and in workshops; applications from engineers with intention of taking licence examination within three months will be entertained.

(B) Licensed aircraft engineers holding A and C endorsements upon York/Merlin and having minimum recent experience of four years upon types; occasional flying duties overseas with crew pay and allowances.

(C) Single licensed inspectors holding York or Merlin endorsements and with minimum recent experience of two years as inspector upon types.

(D) Airframe and engine fitters having minimum three years' recent experience upon type.

(E) Technical records clerk, able compile and maintain progressive overhaul records, responsible all aircraft logs and allied documentation; capable maintaining modification and drawing library.

ALL applications, stating age, experience, licence number and date of issue of endorsement to:—PERSONNEL EAGLE AVIATION, Luton Airport, Beds [5747

FITTERS, airframe and engines, for maintenance of light aircraft; licence holders preferred.

APPLY Messrs. Airschools, Ltd., Wolverhampton Airport. Tel. Fordhouses 2191. [5724

AIRWORK, Ltd., urgently require the following personnel for employment as stated:—

IN Lincolnshire and the Home Counties: Flying Instructors with previous R.A.F. ab initio training experience, BI Category minimum.

IN England, Scotland and Northern Ireland: Maintenance Test Pilots with wide experience of current Service types both single- and twin-engined; applicants must have current instrument rating; indoctrination Courses will be arranged for suitable applicants.

WRITE, giving full particulars, to Airwork, Ltd., Sutton Lane, Langley, Bucks. Envelopes to be marked "Flying Training." [5722

APPLICATIONS are invited for the following vacancies in a development research laboratory of a prominent aircraft company:—

1.—Metallurgist (mainly light alloys) with strong engineering degree; duties will include advising design office of properties of materials and fabrication aspects, the initiation of associated test programmes, and technical liaison with metal manufacturers; opportunities for advancement when proved suitable.

2.—Technician (male or female), minimum standard Higher National Certificate or equivalent, duties will include supervision of a small group of technicians engaged in accurate testing of materials; previous experience in this field essential.

REPLIES to Box 8050. [5759

TECHNICAL Assistant required for development of pneumatic equipment; University degree in mech. engineering essential, and experience in aircraft industry preferred.—Write full details and salary expected to Personnel Officer, Hymatic Engineering, Ltd., Redditch [5751

BRITISH OVERSEAS AIRWAYS CORPORATION require sheet metal workers, airframe fitters and engine fitters at London Airport; rates of pay 2/7 per hour plus 4½d per hour provisional bonus; attracting proficiency pay up to 3d per hour; 5-day, 44-hour week; pension scheme facilities.—Apply immediately to Staff Manager, B.O.A.C., London Airport, Feltham Middlesex. [5740

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MALE and female inspectors urgently required by aircraft constructors in the West.—Apply, giving age, experience, etc., to Box 7758. [5706

VACANCIES; four senior draughtsmen, must have had design experience, airframe and equipment.—Apply writing. Chief Designer, Hellwells, Ltd., Walsall Airport. [0704

JIG and tool draughtsmen, experienced, required. pension and life assurance scheme.—Apply Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [5716

GOOD senior draughtsman required for interesting programme of new work.—Apply in the first instance to the Chief Engineer, Percival Aircraft, Ltd., The Airport, Luton. [0593

DRAUGHTSMEN.—Opportunities for a few young draughtsmen exist in the Industrial Gas Turbine Department of an East Midland firm; applicants with Higher National Certificate will be considered.

APPLICATIONS stating age, experience and salary required to—Box 7985. [5752

APPLICATIONS are invited from design draughtsmen and stressmen also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.

APPLICATIONS should state full particulars of experience and qualifications and should be addressed to The Personnel Manager, The de Havilland Engine Co., Ltd., Stonegrave, Edgware, Middx. [0575

SENIOR draughtsman required, previous aircraft experience desirable; pension and life assurance scheme.—Apply Employment Manager, Vickers-Armstrongs, Ltd., Weybridge. [5662

SENIOR draughtsmen required, previous aircraft experience desirable; pension and life assurance scheme.—Apply Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [0565

SENIOR press tool designer required by aircraft firm in the Midlands, capable of designing heavy deep-drawing tools, good prospects for right man.—Apply, stating age, experience and salary to Box No. 7859. [5715

GLOSTER AIRCRAFT Co., Ltd., have vacancies for senior jig and tool draughtsmen; write giving full details of previous experience, age and salary required to—Employment Officer, G.A.C., Ltd., Hucclecote, Glos [5729

AIRCRAFT loftsmen (senior) required, sound experience in similar capacity essential.—Applications in writing, stating age, experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., The Airport, Luton, Beds. [0595

SIVEWRIGHT AIRWAYS require co-pilots, applicants with Dakota, Rapide endorsements preferred; instrument rating essential; chief engineer, A. B. C. and X, covering Dakota, Rapide preferred.—Apply, Chief Pilot, Ringway Airport, Manchester. [5746

PROMINENT aircraft firm in Greater London area, commencing new project of great National importance, offers unique opportunity for advancement, high salaries with monthly staff status and pension scheme offered to suitably qualified applicants.

AERODYNAMICISTS with first-class honours degree in mathematics or engineering, preferably with several years' practical experience, though not essential.

ELECTRONIC engineers with first-class honours degree or equivalent qualification.

SENIOR designer draughtsman (section leader status) with degree standard of education or Higher National Certificate, experience in one or more of the following is desirable:—

HYDRAULIC systems, servo amplifiers.

GYRO mechanisms.

APPLY, stating age, nationality and experience, to Box AC58213, Samson Clarke, 57-61, Mortimer Street, W.1. [1717

SENIOR and junior design draughtsmen with experience in light hydraulic Servo controls and/or fuel metering equipment; also technicians with development experience in this field.—Write, Personnel Manager, Dowty Equipment, Ltd., Arle Court, Cheltenham. [5689

THE AERODROME OWNERS' ASSOCIATION and the British Air Charter Association, 19, Park Lane, W.1, invite applications for a secretary who must have wide background of aeronautical experience and as many of the following qualifications as possible:—

AERONAUTICAL engineering experience; air transport and aerodromes; know and be known to personalities in the aviation world, and have had experience of negotiations with Government Departments; journalistic and ordinary business knowledge; knowledge of languages an advantage but not essential.

SALARY according to qualifications and experience; apply in writing only. [5745

SITUATIONS VACANT

AERODYNAMICIST (male) required, degree in mathematics or engineering and several years' practical experience in aerodynamics section essential.—Applications in writing, stating age, experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds [0592

THE de Havilland Aircraft Co., Ltd., have vacancies for a technical author and technical illustrators, previous aircraft experience essential.—Apply in writing, stating age, experience and salary required to Chief Draughtsman, The de Havilland Aircraft Co., Ltd., Hatfield, Herts. [5720

HANDLEY PAGE, Ltd., invite applications for a position as senior draughtsman for work on aircraft ground equipment; previous experience in this type of work essential.—Write, stating age, qualifications and experience, to Staff Officer, Handley Page, Ltd., Claremont Rd., London, N.W.2. [5700

TECHNICAL artist, experienced in executing full colour sectioned electrical component drawings, required for publications department; the position is superannuated and gives considerable scope to an ambitious man with adequate experience.—Write, stating experience, age and salary required, to Box 7972. [5746

INTERNATIONAL AERADIO, Ltd., require radio mechanic, ground duties overseas, single candidates preferred; experience installation, maintenance airfield equipment; minimum inclusive emoluments approximately £500, free quarters, passages, low tax, pensions fund.—Write Personnel Officer, 40, Park St., W.1. [5758

SENIOR Technical Assistant required for aero engine stress office; knowledge of reciprocating and gas turbine engines desirable, B.Sc. or equivalent preferred; write giving age and full details of previous experience and salary required to—The Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middx. [5755

ELECTRICAL field service representative required by aircraft manufacturers' service department in the south; applicants must possess extensive knowledge and outstanding practical experience of the servicing and repair of modern aircraft electrical systems; a current "A" licence and a flair for service work.—Box 7971. [5744

APPLICATIONS are invited from senior and intermediate design draughtsmen, experience of aero engine design desirable but not essential.—Please write, stating age and giving details of previous experience in chronological order, to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [0449

THE DE HAVILLAND AIRCRAFT Co., Ltd., have vacancies for senior design and intermediate draughtsmen (preferably with aircraft experience) in their Hatfield and London (Regent Street) offices.—Applications stating age, experience and salary required, to Chief Draughtsman, de Havilland Aircraft Co., Ltd., Hatfield, Herts. [5564

ELECTRICAL draughtsman, familiar with light mechanisms or instruments and preferably with some circuit experience, required by Dowty Equipment, Ltd., Arle Court, Cheltenham, for their electrical development department, age 21-25, Higher National Certificate preferred.—Write to Personnel Manager stating age, experience and salary required. [5737

SENIOR aerodynamicists required for work on high performance aircraft, applicants should have an engineering degree and experience in design of controls, performance calculations and estimation of aerodynamic loads.—Write, giving particulars of age, experience and salary required, to Employment Manager, Vickers-Armstrongs, Ltd., Weybridge. [5663

TEST engineers required as from January 1st for development work on aircraft hydraulic systems; previous experience essential; age 21-35.—Apply in writing, stating age, experience and salary required, or by telephone, to Mr. R. T. Sewell, Chief Test Engineer, British Messier, Ltd., Cheltenham Rd. East, Gloucester. Tel. Churchdown 3281. [5696

AIRCRAFT Draughtsmen are required by the English Electric Co., Ltd., to meet an expanding programme at their Warton and London design offices; draughtsmen of all grades with appropriate aircraft experience are invited to apply for these vacancies; write quoting ref. 120D, to—Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1. [5730

HANDLEY PAGE (READING), Ltd., have vacancies in their design office for stressmen who should have at least two years' experience and with qualifications up to A.F.R., Ae.S. or B.Sc. standard, these vacancies carry excellent prospects for the right men.—Send full particulars to the Personnel Officer, Handley Page (Reading), Ltd., The Aerodrome, Woodley, Reading. [0574

SITUATIONS VACANT

SENIOR aerodynamicists required for work on high-performance aircraft; applicants should have an engineering degree and experience in design of controls, performance calculations and estimation of aerodynamic loads.—Write, giving particulars of age, experience and salary required, to Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [0566

YOUNG mechanical engineer having a mathematical bias, required for calculations in connection with the design of aircraft gas turbine fuel system controls; applicants should have an engineering degree or equivalent. The position is permanent and offers good scope for advancement.—Write, stating age, qualifications and experience, to Personnel Manager, Joseph Lucas, Ltd., Gt. King St., Birmingham. [5743

STRESS or mechanical test engineers are required for the Aircraft Division of the English Electric Co., Ltd., at Warton Aerodrome, near Blackpool; these are interesting vacancies on new projects offering good prospects to suitably qualified engineers experienced in either of these fields.—Write giving full details and quoting ref. 434B to Central Personnel Services, English Electric Co., Ltd., 24/30, Gillingham St., London, S.W.1. [5736

AERODYNAMICISTS with an engineering degree and good mathematical background are required for the Aircraft Division of the English Electric Co., Ltd., at Warton Aerodrome, near Blackpool; previous experience is desirable but suitably qualified engineers without previous experience in aerodynamics who desire to enter this field will be given necessary training.—Write giving full details and mentioning ref. 435E to Central Personnel Services, English Electric Co., Ltd., 24/30, Gillingham St., London, S.W.1. [5735

BRITISH OVERSEAS AIRWAYS CORPORATION require a draughtsman at London Airport for the preparation of design drawings for development and research modifications and repairs, etc., to aircraft; previous experience in aircraft engine or airframe design preferred, but applicants with experience in other forms of engineering considered; A.E.S.D. rates according to qualifications; 5-day 37½ hr week, pension scheme facilities.—Apply Staff Manager, B.O.A.C., London Airport, Feltham, Middx. [5760

HANDLEY PAGE, Ltd., have vacancies for senior design and intermediate draughtsmen, preferably with aircraft experience for their Cricklewood and Radlett offices; consideration will be given to applicants with experience in light structural or mechanical engineering, possession of O.N.C. or H.N.C. (Mech. or Elect.) an advantage; loftsmen with previous experience of full scale layout work or similar workshop practice; these vacancies are at the Cricklewood office only.—Applications, stating age, qualifications and details of experience, to Staff Officer, Handley Page, Ltd., Cricklewood, London, N.W.2. [5684

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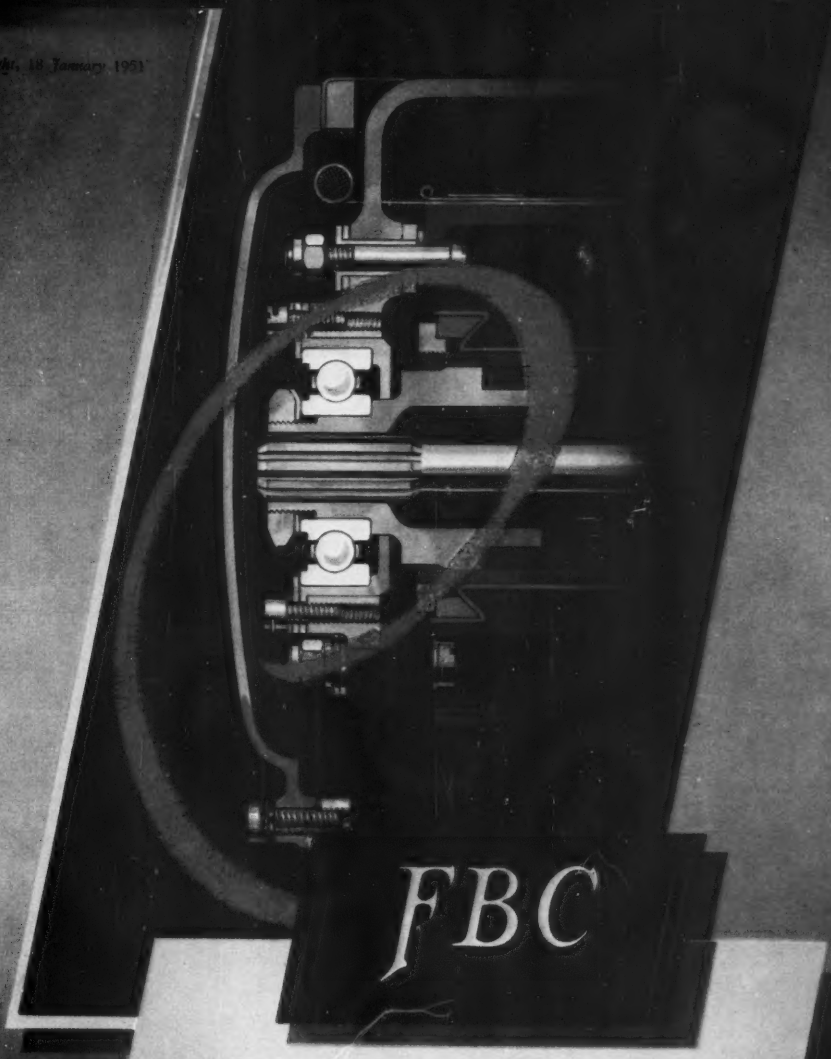

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